SAMPLING AND ANALYSIS PLAN - VOLUME II
QUALITY ASSURANCE PROJECT PLAN

FOR THE
GULFCO MARINE MAINTENANCE
SUPERFUND SITE
FREEPORT, TEXAS

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1.0 INTRODUCTION

The United States Environmental Protection Agency (EPA) named the former site of Gulfco Marine Maintenance, Inc. in Freeport, Brazoria County, Texas (the Site) to the National Priorities List (NPL) in May 2003. The EPA issued a modified Unilateral Administrative Order (UAO), effective July 29, 2005, requiring Respondents to conduct a Remedial Investigation and Feasibility Study (RI/FS) for the Site. This Quality Assurance Project Plan (QAPP) was prepared as Volume II of a Sampling and Analysis Plan (SAP) in accordance with Paragraph 27.b of the Statement of Work (SOW) for the RI/FS included as an Attachment to the UAO. The QAPP was prepared by Pastor, Behling & Wheeler, LLC (PBW), on behalf of LDL Coastal Limited LP (LDL), Chromalloy American Corporation (Chromalloy) and The Dow Chemical Company (Dow) (collectively referred to as Respondents in the UAO).

The QAPP format and elements have been developed in accordance with guidance developed by the United States Environmental Protection Agency (EPA, 2001; EPA, 2002). The plan presents the policies, organization, objectives, functional activities, and other specific Quality Assurance/Quality Control (QA/QC) activities designed to achieve the precision, accuracy, completeness, comparability, and representativeness required to make the data quality acceptable for the RI/FS. A general description of RI/FS activities is provided in the RI/FS Work Plan (PBW, 2006a). Specific sampling locations and procedures are described in Volume I of the SAP, the Field Sampling Plan (FSP) (PBW, 2006b).

2.0 PROJECT MANAGEMENT

2.1 PROJECT ORGANIZATION

The general project organization is presented in Figure 1. This chart shows the primary members of the project management team, and lists the current site contractors. Roles and responsibilities for the Project Coordinator and other team members are described in the RI/FS WP. The responsibilities of the persons assigned to QA/QC activities are listed below.

2.1.1 Respondents' Project Coordinator

The Respondents' Project Coordinator will provide the principal point of contact and control for matters concerning the project and field investigation implementation. In consultation with the Respondents, the Project Coordinator will:

- Coordinate field investigation activities and develop a detailed schedule;
- Establish project policies and procedures to meet the specific objectives of the project;
- Orient all field staff concerning the project;
- Develop and meet ongoing project staffing requirements, including mechanisms to review and evaluate each work product;
- Review the work performed on each project to help ensure its quality, responsiveness and timeliness; and
- Represent the project team at meetings and public hearings, if necessary.

The Project Coordinator is responsible for implementation of the QA program in conformance with this QAPP. Final responsibility for project quality rests with the Project Coordinator.

2.1.2 Remedial Investigation Manager

The RI Manager will direct and supervise all RI work. The RI Manager's responsibilities will be to review all RI project work to ensure that it meets the specific project goals, meets technical standards, and is in accordance with the objectives and procedures discussed herein.

2.1.3 Quality Assurance Manager

The Quality Assurance Manager (QA Manager) will remain independent of direct involvement in day-to-day operations, but will have direct access to staff, as necessary, to resolve any QA issues. The QA Manager has sufficient authority to stop work on the investigation as deemed necessary in the event of serious QA/QC issues. Specific functions and duties include:

- Performing QA audits on various phases of the project's operations, as necessary;
- Reviewing and approving this QAPP and other QA plans and procedures;
- Performing validation of data collected relative to RI/FS activities and this QAPP; and
- Providing QA technical assistance to project staff.

The QA Manager will notify the Project Coordinator of particular circumstances that may adversely affect the quality of data and ensure implementation of corrective actions needed to resolve nonconformances noted during assessments.

2.1.4 Field Supervisor

The Field Supervisor will be responsible for all aspects of field work performed as part of a specific RI/FS activity. Different project subtasks or activities may have different Field Supervisors. Duties of the Field Supervisor will include:

- Maintaining field records;
- Continually surveying the Site for potential work hazards and relate any new information to site personnel at the Tailgate Safety Meeting held each day prior to beginning field activities.

- Ensuring that field personnel are properly trained, equipped, and familiar with Standard Operating Procedures and the Health and Safety Plan;
- Overseeing sample collection, handling and shipping; ensuring proper functioning of field equipment; and
- Informing the laboratory when samples are shipped to the lab and verifying samples arrived at the lab.

The primary duty of the Field Supervisor is to ensure that the field sampling is performed in accordance with the project sampling plans and this QAPP. The Field Supervisor will also require that appropriate personal protective equipment will be worn and disposed of according to the Health and Safety Plan (PBW, 2005). In addition, the Field Supervisor may be responsible for preparing monitoring reports for review by the Project Manager.

2.1.5 Analytical Lab Project Manager

The Analytical Laboratory Project Manager will work directly with the Field Supervisor and QA Manager and will be responsible for the following:

- Ensuring all necessary laboratory resources are available to meet project schedules;
- Shipping sample containers and preservatives to the field samplers;
- Overseeing production and final review of analytical reports;
- Coordinating laboratory analyses;
- Supervising in-house chain of custody (COC);
- Scheduling sample analyses;
- Overseeing laboratory data review;
- Approving final analytical reports prior to submission;
- Overseeing laboratory QA;
- Overseeing QA/QC documentation;
- Defining appropriate laboratory QA procedures; and

- Determining whether to implement laboratory corrective actions, as required.

2.2 PROBLEM DEFINITION/BACKGROUND

As described in the RI/FS WP, the overall problem to be addressed by the RI/FS is to evaluate the nature and extent of contamination at and from the Site, assess the risk from this contamination to human health and the environment, and evaluate potential remedial alternatives. Consistent with this overall problem, the specific objectives of this RI/FS are to: (1) characterize site conditions; (2) evaluate the nature and extent of the contamination; (3) assess the risks to human health and the environment; (4) identify remedial action objectives for those chemicals and media posing an unacceptable risk; (5) develop preliminary remediation goals (PRGs) to address the remedial action objectives; (6) develop, screen and evaluate potential remedial technologies consistent with the PRGs; (7) examine the potential performance and cost of the remedial alternatives that are being considered; and (8) select the appropriate alternative for site remediation.

The technical approach for meeting these objectives is described in detail in the RI/FS WP, and includes the following overarching components:

- Use of existing data from previous site investigations;
- Incorporation of TRIAD Approach elements, including systematic project planning, dynamic work strategies; and real-time measurement technologies;
- Focus on potential receptors and an evaluation of the risks associated with the potential exposure pathways identified in the Conceptual Site Model (CSM) through a receptor-based investigation program;
- Consideration of Site end use objectives in terms of land use/zoning, and potential site development issues, particularly to the extent that the Site remedy supports and may even augment Site development plans; and
- Recognition of potential contributions from natural processes to Site remediation.

2.3 PROJECT/TASK DESCRIPTION

This QAPP has been developed to address the activities described in the RI/FS WP and in the FSP. Protocols that will be followed for sample handling and storage, chain of custody, laboratory analyses, reporting, data validation, and corrective actions are described in this QAPP, or will be added to the QAPP as they become necessary. The information contained in this QAPP is intended for use in conjunction with the sampling methods and procedures described in detail in the FSP.

The goal of the QAPP is to assure that the data collected meet the project objectives established in Section 2.4. All QA/QC procedures will be in accordance with applicable professional standards, government regulations and guidelines, and specific project goals and requirements.

Samples will be submitted to the analytical laboratory for analysis. Sample data will first be verified by reviewing field documentation and chain-of-custody records. The laboratory will internally verify the data by reviewing documentation of sample receipt, sample preparation, sample analysis, laboratory QC samples, data reduction and data reporting. Data verification and validation will then be conducted in accordance with the procedures presented in Section 5.0 of this QAPP.

Consistent with the TRIAD approach, should any field analytical methods, including field screening methods for evaluating the presence of non-aqueous phase liquids (NAPL), be employed, a Demonstration of Method Applicability (DMA) will be prepared and submitted to EPA for review and approval.

2.4 PROJECT OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

Data quality objectives (DQOs) are qualitative and quantitative statements derived from the outputs of each step of the DQO process. The DQO process is a series of planning steps based on the scientific method that is designed to ensure that the type, quantity and quality of environmental data used in decision-making are appropriate for the intended application (EPA, 2000a).

There are seven steps in the DQO process which are:

1) Stating the problem;
2) Identifying the decision;
3) Identifying inputs to the decision;
4) Defining the boundaries of the study;
5) Developing a decision rule;
6) Specifying limits on decision errors; and
7) Optimizing the design for obtaining data.

The problem, as stated in Section 2.2 of this QAPP, is to: a) evaluate the nature and extent of contamination at and from the Site and also assess the risk from this contamination to human health and the environment; b) provide sufficient site data necessary to evaluate remedial technologies; and c) evaluate alternatives for addressing the risk to human health and the environment from the contamination at and from the Site. This problem statement is consistent across all types of data needs.

In accordance with the above seven step process, DQOs were developed by media for the CSM exposure routes and associated data needs identified in Table 13 of the RI/FS WP as follows:

- Table 1 – Soils/Sediment;
- Table 2 – Groundwater;
- Table 3 – Surface Water; and
- Table 4 – Fish Tissue.

In addition, geotechnical investigation DQOs are provided in Table 5.

Based on the DQOs, the project analytical objectives for each media can be summarized as presented in Table 6. All measurements must be made so that results are of sufficient quality (i.e., technical validity and legal defensibility) to support the project objectives. As such, all data collected should meet the following criteria:

- Sampling – Samples will be collected using approved standard operating procedures.

- Documentation – Sample custody will be documented to maintain security and show control during transfer of samples from collection through disposal.

- Laboratory – The analytical laboratory will have a documented quality system which complies with ANSI/ASQC E-4 1994, "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs," (American National Standard, January 5, 1995) and "EPA Requirements for Quality Management Plans (QA/R-2)" (EPA/240/B-01/002, March 2001). This requirement is considered met by laboratories accredited under the National Environmental Laboratory Accreditations Program (NELAP).

- Analysis – Data must be definitive (i.e., generated using rigorous analytical methods such as an EPA-approved method, ASTM standard method, or laboratory method that is formally documented and demonstrated to be applicable).

- Quality Control (QC) – Measurement performance criteria for both field and laboratory QC must be based on the intended use and should be a function of sampling design, requirements in the analytical methods, and standard accepted practice.

- Sensitivity – For data that will be used in quantitative risk assessment, the Method Detection Limit (MDL) should be less than the Preliminary Screening Values (PSV) as defined in the RI/FS WP. If it is not possible to achieve an MDL below the PSV, then the standard available method with the lowest possible MDL shall be used for that analyte. The laboratory should routinely check the MDLs for reasonableness and update them as necessary.

2.4.1 Analytical Methodologies

Appropriate analytical methodologies have been selected based on the criteria presented in Section 2.4 and presented for each media in Appendices A through E. Additionally, Appendices A through E summarize the method requirements for sample preservation and holding time.

2.4.2 Data Quality Indicators/Performance Criteria

Performance goals have been established based on the criteria presented in Section 2.4 for each of the Data Quality Indicators (Precision, Accuracy, Completeness, Representativeness, and Comparability) as defined below.

2.4.2.1 Precision

Precision is a measure of the reproducibility between two or more measurements of the same characteristic (i.e., analyte, parameter) under the same or similar conditions. Determining the agreement among replicate measurements of the same sample assesses the precision of the analytical procedure; combined precision of sampling and analysis procedures is assessed from the agreement between measurements of field duplicate samples. The relative percent difference (RPD) in the results will be computed for each duplicate pair using the equation provided in Section 3.6.

Field Precision Objectives

Precision of sampling and analysis procedures will be assessed through the collection of field duplicate samples at the frequencies listed in Appendices A through E for the specific media. The goals for precision of field duplicate results are also listed in the appendices. Data for duplicate analyses will be evaluated only if both of the samples in the duplicate pair have a concentration greater than the method quantitation limit (MQL). It is noted here that natural variation in some of the matrices will affect how closely these goals are met; that is, if variation is high, then these goals are unrealistic. Consequently, RPD results from field duplicates will not be used as a basis for invalidating any analytical data.

Laboratory Precision Objectives

Precision of the analytical procedure will be assessed through duplicate analyses of laboratory QC and field samples. Data for duplicate analyses will be evaluated only if both of the samples in the duplicate pair have a concentration greater than the method quantitation limit (MQL). The precision goals for laboratory duplicates for each media/analyte are listed in Appendices A though E.

2.4.2.2 Accuracy

Accuracy is a measure of the bias in terms of the degree of agreement between an observed value (i.e., sample result) and the accepted reference or true value. Accuracy is expressed as the

percent recovery of spiked analytes. The equations used to calculate percent recovery are included in Section 3.6.

Laboratory blank samples and field blanks will also be used to quantify the effect of sample contamination on overall data accuracy.

Field Accuracy Objectives

The potential for field contamination will be assessed through collection of equipment blanks (when non-dedicated sampling equipment is used) and trip blanks (for VOC samples) and adherence to all sample handling, preservation and holding time requirements. The objectives for minimizing the effect of field contamination on sample accuracy are listed for each media in Appendices A through E.

Laboratory Accuracy Objectives

Laboratory accuracy will be evaluated by the analysis of laboratory control samples (LCS), matrix spike (MS) samples and surrogate spikes (SU), with results expressed as a percentage recovery measured relative to the true (known) concentration. Laboratory LCS, MS/MSD, and SU recovery goals are provided in Appendices A through E for each media. In addition, laboratory preparation blank results will be used to measure any contamination introduced during the analytical process. The objectives for minimizing the effect of laboratory contamination on sample accuracy are concentrations less than the MQL in all blank samples.

2.4.2.3 Completeness

Completeness is the percentage of valid measurements or data points obtained, as a proportion of the number of measurements or data points planned for the project. Completeness is affected by such factors as sample bottle breakage and acceptance/rejection of analytical results. Completeness will be re-calculated and presented in each validation checklist. If completeness approaches the established goal (within 2-3%), corrective action will be instituted as described in Section 4.0. The completeness goal on a sample level is 90% and the goal on an analyte level is 80%.

2.4.2.4 Representativeness

Representativeness is a qualitative objective, defined as the degree to which data accurately and precisely represent the characteristic of a population, the parameter variations at a sampling point, the process condition, or an environmental condition within a defined spatial and/or temporal boundary.

Field Representativeness Objectives

Field representativeness is achieved by collecting a sufficient number of unbiased (representative) samples and implementing a QC program for sample collection and handling prior to analyses. The sampling approaches developed for this project will provide for samples that are representative of site conditions. Any equipment blank and field blank results will also be evaluated to ensure that analytical results are representative of sample concentrations.

Laboratory Representativeness Objectives

Representativeness in the laboratory is ensured by using the proper analytical procedures, appropriate sample handling and preparation methods, meeting sample holding times and analyzing and assessing duplicate samples.

2.4.2.5 Comparability

Comparability is the confidence with which one data set can be compared to another.

Measures to Ensure Comparability of Field Data

Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the standard field protocols in the FSP are consistently followed and that the sampling techniques specified in the sampling plan are consistently used.

Measures to Ensure Comparability of Laboratory Data

Planned analytical data will be comparable when the sampling and analytical methods described in the FSP and in this QAPP are used for sample collection and laboratory analysis. This goal is achieved through the consistent use of standard techniques to collect and analyze representative samples. Results of sample analyses will be consistently reported in appropriate units. Comparability is also dependent upon the laboratory obtaining the QA objectives for accuracy and precision. All data that meet the QA objectives described in this document and are considered usable will be considered comparable data.

2.5 QUALITY OBJECTIVES AND CRITERIA FOR HISTORICAL DATA

For secondary data (data that were previously collected for a different intended use), acceptance criteria are used in place of measurement performance criteria. Historical data that have been obtained using standard sampling techniques, custody documentation, and definitive analytical procedures and that have been previously validated and not rejected for serious QC deficiencies are considered acceptable for nature and extent and quantitative risk assessment purposes. These previously validated existing data will be reviewed prior to use to ensure consistency (particularly in terms of data flag usage and reporting format such as units, reporting limits, etc.), with data validation procedures for data obtained during the RI/FS.

Historical data that have not been previously validated and that will be used for nature and extent or risk assessment purposes will be validated in accordance with the procedures described in Section 5.0. Historical data that have not been obtained using standard sampling techniques, custody documentation, and definitive analytical procedures may only be used qualitatively.

2.6 SPECIAL TRAINING/CERTIFICATION

All field personnel who will collect samples addressed by this QAPP will have received 40 hour OSHA Hazardous Waste Site Operations training with annual 8-hour refreshers and medical monitoring. All personnel shall also have received 24 hours of supervised field training. The Field Project Supervisor shall have completed an additional 8-Hour OSHA Supervisor training

course. The Site Safety Officer shall hold a current certificate for first aid/CPR training. Other training may be instituted as required. The RI Manager will be responsible for assuring that all required training is obtained and for maintaining all records documenting the required training.

2.7 DOCUMENTS AND RECORDS

The Respondents' Project Coordinator will distribute the QAPP to the persons listed on the distribution list on page vii of the QAPP. The Project Coordinator will be responsible for ensuring that all addenda are provided to the persons on this list, such that they will have the most current approved version of the QAPP. Updates to the QAPP will be controlled through use of a revision header on each page. This header will note the date of the revision and the revision letter (D for draft and F for final) followed by a revision number.

The FSP will also be distributed as indicated on this list. All QA audit reports, progress reports, corrective action reports and validation checklists will be maintained by the Project Coordinator with a copy retained by the QA Manager. Other project documents will be managed as described below.

2.7.1 Field Operation Records

Field operation records include sample collection records, chains of custody (COCs), custody seals, QC sample records, field procedures, and corrective action reports. Field sampling activities are documented on field data sheets. At each site, station IDs, location, sampling time, date, and sample collector's name/signature are recorded. The type of sample collected from each location will be recorded and serve as a check to assure that all intended samples are collected. If a field or lab QA/QC sample is to be collected at a site for a specific sample, this information will be documented on the field data sheets.

Values for all measured field parameters will be recorded. Observational data will be recorded, for instance water appearance, weather, biological activity in the sample, unusual odors, and other sample specific information.

COCs will be filled out for all samples collected and include the information documented in Section 3.3 below.

Any problems or comments related to a specific sample will also be documented on the field data sheet. Such information would include moving a station location, if analytical samples require composites to be generated from more than one sample or if there were any circumstances at a site that prevented a sample from being collected.

Any corrective actions necessary to insure that sample integrity is maintained will be documented. If field standard operating procedures (SOPs) are violated or deviations are made, a corrective action report will be documented indicating what occurred, actions taken to correct the failure, as well as the effect of the action on the sample in question.

2.7.2 Laboratory Records

Laboratory records will include all of the data in the data reporting package (described in a later section. In addition to the items in the data reporting package, at a minimum, the following records will be maintained by the laboratory:

- Sample preparation log books;
- Standard solutions preparation log books;
- Temperature records for storage units (standards, samples);
- Equipment calibration and maintenance records; and
- Certification records for standards.

2.7.3 Data Handling Records

Data generated as part of this project will be handled according to the data management steps outlined in Section 3.10, as well as the verification and validation procedures identified in Section 5.0 of this document.

2.7.4 Laboratory Data Reporting Package Format/Documentation Control

The analytical laboratory will prepare Level IV data packages for all analyses. The data package will include the following reportable data:

- A signed narrative which includes a detailed discussion of non-conformity events, corrective measures, data deficiencies, sample dilutions required, any evidence of matrix interference, etc.
- Complete Chain-of-Custody Documentation;
- Laboratory Sample Receipt Forms;
- Sample Identification and QC Batch Cross-Reference Table;
- Test Reports for Samples;
- Surrogate Recovery Data;
- Test Reports for Laboratory Blank Samples;
- Summary Forms for Laboratory Control Samples (LCS);
- Summary Forms for Matrix Spike/Matrix Spike Duplicate (MS/MSD);
- Summary Forms for Laboratory Duplicates;
- Summary Forms for Internal Standards;
- Summary Forms for GC/MS Tuning;
- Summary Forms for Metals Interference Check Samples, Serial Dilutions and MSA;
- Summary Forms for GC Dual Column/Detector Confirmation;
- Summary Forms for Pesticide Breakdown;
- Instrument run logs, extraction logs, and digestion logs;
- Initial calibration data with summary report;
- Initial calibration verification (ICV) data with summary report;
- Continuing calibration verification (CCV) data with summary report;

- Initial calibration blank (ICB) data with summary report;
- Continuing calibration blank (CCB) data with summary report;
- Method detection limit documentation;
- DCS Documentation for reasonableness check of MDL; and
- Raw data (instrument printouts, chromatograms, mass spectra) for all samples, QC samples, and standards.

Test Reports shall include both the Method Detection Limit (MDL) and Method Quantitation Limit (MQL) adjusted to reflect sample-specific actions, such as dilution or use of smaller aliquot sizes than prescribed in the analytical method, and which take into account sample characteristics, sample preparation, and analytical adjustments. The MDL shall be determined by the laboratory using the procedures in 40 CFR Part 136, Appendix B and should be routinely checked for reasonableness using the procedures for the Detectability Check Sample (DCS) as established by the Texas Commission on Environmental Quality (TCEQ). The Method Quantitation Limit shall correspond to the lowest non-zero concentration standard in the laboratory's initial calibration curve and is based on the final volume of extract (or sample) used by the laboratory. Non-detected results shall be reported as less than the value of the sample-specific MDL. Concentrations between the MDL and MQL shall be reported with a J-flag flag (or B-flag for inorganics) to indicate the concentration is an estimate. Aqueous results shall be reported in mg/L for inorganics and µg/L for organics. Soil and sediment data shall be reported in mg/kg for inorganics and µg/kg for organics and shall be corrected for dry-weight. For GC analyses requiring secondary confirmation (i.e., Pesticides by SW-846 Method 8081 and PCB-Congeners by SW-846 Method 8082), the lower result shall be reported unless the relative percent difference (RPD) between the results exceeds the method criteria (40%) and there is no clear interference. The narrative should include a discussion of any disparity between results.

Summary Forms shall include the applicable QC parameter (i.e., RSD, recovery, RPD, etc.) for each analyte along with the true or reference amount, the measured amount, and the laboratory control limits. The Laboratory Control Samples shall contain all target analytes for the analytical method as listed in Appendices A-E, which are routinely spiked by the laboratory. The Matrix Spike and Matrix Spike Duplicates (MS/MSDs) must be prepared using a sample from the Site

(as indicated on the Chain-of-Custody) and shall contain the same target analytes as the LCS at an appropriate level compared to the unspiked sample result.

Data reporting packages will be organized according to the analytical laboratory's sample data groups (SDGs). Data reporting packages will be prepared by the Analytical Lab Project Manager in both paper and electronic form. One paper copy and one electronic copy (on CD) of each data package will be submitted to the RI Manager. The electronic copy will be in portable document format (pdf) with all pages numbered sequentially. Data in Microsoft Excel or Microsoft Access will also be required in order to enter the data into a database. The pdf files will be read-only such that data items cannot be edited. Electronic copies will be provided on CD and by electronic mail.

2.7.5 Data Archiving and Retrieval

The documents that describe, specify, report, or certify activities, requirements, procedures, or results for the various activities and the items and materials that furnish objective evidence of the quality of items or activities are listed in Table 7. All field-collected data will be housed in its original format. Table 7 shows documents and record types, locations where these records will be housed, retention time and the form of the record. Laboratory data that are stored electronically will be archived electronically, and where printed as part of the paper data report package, will also be archived in paper form. In general, all records must be retained for a period of 10 years following commencement of construction of any remedial action which is selected following completion of the RI/FS, per Section XX, Paragraph 79 of the UAO.

3.0 DATA GENERATION AND ACQUISITION ELEMENTS

3.1 SAMPLING PROCESS DESIGN

Project sampling processes were designed to obtain information necessary to address those data needs associated with potentially complete or indeterminant exposure routes as described in the CSM, and identified during the RI/FS scoping process as described in the RI/FS WP. The DQOs in Tables 1-5 were developed for those identified potential exposure routes on a media-specific basis. As shown on Figure 10 of the RI/FS WP and detailed in the FSP, the sampling processes are iterative based on the data obtained and comparisons to Preliminary Screening Values (PSVs).

3.1.1 Scheduled Project Activities

Schedules for each sampling activity are shown on Figure 11 of the RI/FS WP.

3.1.2 Rationale for the Design

The overall rationale for the design of the RI/FS program is discussed in Section 4.0 of the RI/FS WP. Design rationale and objectives for specific tasks, including data generation subtasks, are provided by task in Section 5.0 of the RI/FS WP and are also evaluated by media in the DQOs. The rationale for the selection of specific sampling locations is included in the FSP. The proposed analytical suite for each sample is related to the Potential Source Area (PSA) associated with that sample, described in the RI/FS WP.

3.1.3 Design Assumptions

The design of the sampling program is based on the CSM, and the data needs resulting from an analysis of the CSM and the DQOs for the media to be sampled. Specific assumptions with regard to individual samples locations are provided in the FSP.

3.1.4 Sample Locations and Frequencies

Sample locations and sampling frequencies, including the type and total number of sample types/matrices and how samples sites will be identified, are specified in Section 3.0 of the FSP.

3.1.5 Critical and Non-Critical Samples

All chemical and physical samples collected are designated as critical samples. Sample integrity is of utmost concern for the activities covered by this QAPP, such that data gaps are not created in the record, and the end user requirements of the data are met.

3.1.6 Validation of Non-Standard Methods

All methods for sample collection are based on standard methods and accepted practices. Should any non-standard field analytical methods be proposed, a DMA will be prepared and submitted to EPA for review and approval prior to use.

3.2 SAMPLING METHODS

All sample methods are described in the FSP. SOPs for these methods are provided in Appendix A of the FSP.

3.2.1 Sample Volume, Containers, and Preservation

The sample volume, container and preservation requirements will be in accordance with requirements for the specific analytical methods. This information is provided in Appendices A through E for the specific activities covered by this QAPP.

3.2.2 Sampling/Measurement System Failure Response and Corrective Action Process

Failure of a sampling or measurement system shall be reported to the Field Supervisor and then to the RI Manager. The RI Manager is responsible for corrective actions, as described in Section 4.

3.3 FIELD SAMPLE HANDLING AND CUSTODY

3.3.1 Chain-of-Custody (COC)

Proper sample handling and custody procedures ensure the custody and integrity of samples beginning at the time of sampling and continuing through transport, sample receipt, preparation, analysis, and disposal.

A sample is in custody if it is in actual physical possession or in a secured area that is restricted to authorized personnel. The COC form is used to document sample handling during transfer from the field to the laboratory and among contractors. The list of items below should be included on the COC form.

- Site identification
- Sample identification
- Date and time of collection
- Sample matrix
- Container type
- Number of containers
- Preservative used
- Notation if the sample was filtered
- Analyses required
- Name and signature of collector(s)
- Custody transfer signatures and dates and time of transfer
- Name of laboratory admitting the samples
- Bill of lading (if applicable)

3.3.2 Sample Labeling

Sample labels are completed with an indelible, waterproof marker. Label information includes the sample identification number, the date and time of sampling and sample type. The sample identification numbering system for the project has been designed to uniquely identify each sampling station and sample according to the Site grid. This numbering system consists of grid column and row identification, sample media, a sequential sample location identifier, depth (if applicable), and QA/QC identifier (if applicable), as detailed in Section 4.0 of the FSP.

3.3.3 Sample Handling

Sample handling procedures for each activity and type of sample are described in the FSP.

3.3.4 Failures in Chain of Custody and Corrective Action

All failures associated with COC procedures are immediately reported to the person who originally signed the COC, typically the Field Supervisor. These include such items as delays in transfer, resulting in holding time violations; violations of sample preservation requirements; incomplete documentation, including signatures; possible tampering of samples; broken or spilled samples, etc. The RI Manager or Field Supervisor, in consultation with the QA Manager will determine if the procedural violation may have compromised the validity of the resulting data. Any failures that have reasonable potential to compromise data quality will invalidate data, and the sampling event should be repeated. The resolution of the situation will be reported to the Project Coordinator. Corrective action reports will be maintained by the QA Manager.

3.4 LABORATORY SAMPLE HANDLING AND CUSTODY

3.4.1 Sample Receipt

Upon receipt by the laboratory, sample integrity will be inspected and documented on the COC or associated document (i.e., a sample receipt report or similar document). Information to be noted on the COC includes: name of person inspecting cooler, integrity of custody seals, sample cooler temperature, evidence of preservation, physical condition of sample container, and airbill number.

The COCs will be reviewed for completeness. If any sample integrity or sample ID problems or discrepancies are found, the Field Supervisor or RI Manager will be notified immediately. A COC addendum or sample receipt report may be used to document the corrective actions used to address any COC discrepancies. If an addendum is not used, corrective actions used to correct COC discrepancies must be recorded directly on the COC. Samples will be stored in a specially designated area that is clean, dry, and refrigerated (if needed). After sample analysis, the unused portion of the sample and sample extracts/digestates, together with all identifying labels will be stored until written permission to destroy the samples is given by the RI Manager. Samples will be disposed of at treatment storage and disposal facilities (TSDFs) that are approved by Respondents. All sample labels will be rendered illegible prior to sample disposal.

3.4.2 Sample Labeling

The field sample number will be recorded on the sample inventory, the COC, and on the sample label. All samples will be assigned discrete sample identification numbers (sample control numbers) upon receipt by the laboratory. The laboratory sample control number will remain the same throughout the analysis and data entry procedures. Final results will be reported with both the field sample ID and the laboratory sample control number.

3.4.3 Sample Custody

The laboratory will be responsible for maintaining an accurate custody record for each sample in the lab. Records will be maintained to document the date and time the sample is checked out of sample storage for analysis and the date and time at which the sample is returned. The Laboratory Project Manager or laboratory contact will be responsible for supplying the Field Supervisor (or their designee) with a sample acknowledgment form within 24 hours of sample receipt. This form will provide sample receipt information, sample log-in information, and the laboratory project number for the samples. A completed, signed COC will be sent by the laboratory to the RI Manager with the final data report.

3.5 ANALYTICAL METHODS

Analytical methods are shown for each activity in Appendices A through E. Laboratory SOPs are provided in Appendix G. Performance-based measurement system (PBMS) methods may also be used as specified in Section 3.5.1.

The SW-846 methods contain inherent flexibility as described in Section 2.1 of Chapter 2 of SW-846. Where this flexibility is employed in this project, documentation shall be provided as described in Section 3.5.2. Consistent with the application of the TRIAD approach during the RI/FS, a DMA will be prepared and submitted to EPA for review and approval prior to use of any field analytical methods.

3.5.1 Performance-Based Measurement System Methods

Performance-based measurement system (PBMS) methods are sample preparation and analytical methods that differ in some part of the procedures of the methods that are specified for this project in Appendices A through E. A PBM system is "a set of processes wherein the data quality needs, mandates or limitations of a program or project are specified, and serve as criteria for selecting appropriate methods to meet those needs in a cost-effective manner."[1] Examples of where PBMS methods may be used in this project are in overcoming matrix interference problems, lowering detection limits, and otherwise improving data quality to meet project DQOs.

If a laboratory uses PBMS methods, it should meet the QA/QC criteria recommended in the SW-846 manual. At a minimum, method performance should be supported by the QC components in Chapter 1 (Quality Control) of SW-846, including the QC information that should be documented. Specifically, Section 4.3.4 (Test Methods) of Chapter 1 describes the minimum written documentation requirements for laboratory procedures. Section 4.4 (Laboratory QA and QC Procedures) of Chapter 1 describes the minimum QA/QC requirements for analytical procedures including proficiency (precision, bias and method detection limit), control procedures

[1] OSWER PBMS Implementation Plan, A Cooperative Effort Among OSW, OERR, OUST, TIO, FFRRO, and CEPPO, October 9, 1998 (revision 1), page 3.

and control limits (laboratory control samples, method blank, and matrix spikes), corrective action, and data handling.

Where PBMS methods are used in this project, documentation shall be provided as described in Section 3.5.2.

3.5.2 Documentation for Alternative Analytical Procedures

Where alternative analytical procedures, such as real-time field analytical methods, are used in this project, demonstration is required that they provide performance equivalent to the methods listed for this project in Appendices A through E. Alternative analytical procedures include those involving the inherent flexibility as allowed in SW-846 methods in Section 2.1 of Chapter 2 of SW-846 as well as those based on PBMS. Documentation of this demonstration will be in a DMA, which will include performance data as well as a detailed description of the procedures such as in an SOP.

3.5.3 Standards Traceability

All standards used in the laboratory are traceable to certified reference materials. Standards preparation is fully documented and maintained in a standards log book. Each document includes information concerning the standard identification, starting materials, including concentration, amount used and lot number, date prepared, expiration date and preparer's initials or signature. The reagent bottle is labeled in a way that traces the reagent back to the preparation.

3.5.4 Failures in Measurement Systems and Corrective Actions

In many cases, the field technician or lab analyst will be able to correct problems. If the problem is resolved by the field technician or lab analyst, he/she will document the problem on the field data sheet or laboratory record and complete the analysis. If the problem is not resolvable, then it is conveyed to the Laboratory Project Manager, who will make the determination and notify the QA Manager. If the analytical system failures may compromise the sample results, the resulting

data will not be reported. The nature and disposition of the problem is reported on the data report, which is sent to the RI Manager.

3.6 QUALITY CONTROL

3.6.1 Sampling Quality Control Requirements and Acceptability Criteria

The minimum field QC requirements are outlined for each activity in Appendices A through E. Specific requirements are outlined below.

3.6.1.1 Field Duplicate

Field duplicates will be collected at the frequency given in Appendices A through E for each sampling activity covered by this QAPP, typically at the frequency of one per 20 field samples collected or at least one per sampling day. A field duplicate is defined as a second sample (or measurement) from the same location, collected in immediate succession, using identical techniques. The duplicate sample will be collected from the same homogenized composite material as the sample it is duplicating and will be submitted "blind" (i.e., without identifying it as a duplicate). Duplicate samples are sealed, handled, stored, shipped, and analyzed in the same manner as the primary sample. Precision of duplicate results is expressed as is calculated by the relative percent difference (RPD) calculated as defined by 100 times the absolute value of the difference (range) of each duplicate set, divided by the average value (mean) of the set:

$$\text{RPD} = \frac{\text{ABS}(\text{primary sample result} - \text{duplicate sample result})}{\text{average of primary and duplicate sample result}} \times 100$$

3.6.1.2 Field Splits

Field splits are not required for any of the activities, but may be requested by the EPA. A field split is collected in the same manner as a field duplicate.

3.6.1.3 Equipment Blanks

Equipment blanks (rinsate) blanks will be collected at the frequency given in Appendices A through E for each sampling activity covered by this QAPP. When possible, rinsate blanks will be collected from the final rinse water of non-dedicated decontaminated equipment to assess the effectiveness of the cleaning and decontamination procedure.

3.6.1.4 Trip Blanks

Trip blanks will be collected at the frequency given in Appendices A through E for each sampling activity covered by this QAPP. Since trip blanks are used only when samples are collected for volatile organic compounds analyses, not all activities will require trip blanks.

3.6.2 Laboratory Measurement Quality Control Requirements and Acceptability Criteria

Detailed laboratory QC requirements are contained within each individual method SOP in Appendix G. The minimum requirements for the QC samples are outlined below. Laboratory QC sample results are reported with the data report.

3.6.2.1 Laboratory Duplicates, Matrix Spikes, and Matrix Spike Duplicates

Duplicate analysis is performed as a measurement of precision on the analytical process. Laboratory duplicates are independently repeated measurements of the same sample, which are performed by the same analyst and under the same conditions. The sample is split in the laboratory and each fraction is carried through all stages of preparation and analysis. The calculation for relative percent difference (RPD) is performed from the two sample results. The equation for calculating RPD was provided in Section 3.6.1.1.

The duplicate procedure is performed at least once per 20 samples (5%). Control limit criteria are found in Appendices A through E for each media.

Matrix spike samples are prepared by adding a known amount of each target analyte (or a subset thereof) to a known amount of sample. The matrix spike is added at the beginning of the

procedure and is carried through the entire measurement process. The sample itself (without a matrix spike) is also carried through the analytical process. In order to produce reliable recovery results, the spike level must be similar to the sample concentration. Because the matrix spike samples are prepared and analyzed at the same time as the sample, only a reasonable estimate of the spike level can be made. Where samples are collected in field areas that are expected to have high concentrations, they will be identified for the laboratory, and corresponding spike levels can be used. The amount of the spike should be at least four times the amount in the unspiked sample.

The spike recovery measures the effects of interferences caused by the sample matrix in the analytical process. The matrix spike recovery is calculated as follows:

$$\% \text{ Recovery} = \frac{\text{spiked sample result} - \text{sample result}}{\text{theoretical spike concentration}} \times 100$$

The matrix spike procedure is performed once per batch of 20 samples. The matrix spike is performed twice and the second spike is called the matrix spike duplicate. This procedure evaluates the precision associated with the procedure and the analyst performing the procedure and is calculated as a RPD as described above.

The sample to be used for the MS/MSD shall be designated on the COC. The MS/MSD is used to document the bias of a method due to sample matrix, not to control the analytical process and thus laboratory corrective action is not instituted based on MS/MSD results. If completeness goals are not being met as described in Section 2.4.4, alternative methodologies will be pursued. Control limit criteria for the MS/MSD are found in Appendices A through E for each media.

3.6.2.2 Laboratory Control Standard (LCS) and Laboratory Control Standard Duplicates (LCSDs)

The laboratory control sample (LCS) is an aliquot of a solid or aqueous certified reference material containing a known amount of each target analyte being measured. The LCS is treated like a field sample from the beginning of the procedure and is carried through the entire measurement process. The amount of the spike should be at a level less than or equal to the

midpoint of the calibration curve for each analyte. The LCS is analyzed once per batch of 20 analytical samples.

The percent recovery of the target analytes in the LCS assists in determining whether the procedure is in control. It is further used to evaluate the accuracy and bias of all or a portion of the measurement process. The LCS recovery is calculated as follows:

$$\% \text{ Recovery} = \frac{\text{measured amount}}{\text{known amount}} \times 100$$

If insufficient quantity of sample is provided to perform a matrix spike and matrix spike duplicate, a duplicate LCS (LCSD) is prepared and analyzed and the RPD is calculated as described in Section 3.6.1.1.

Control limit criteria for the LCS are found in Appendices A through E for each media. If the LCS recovery is lower than the control limit or if the LCS recovery is higher than the control limit and the analyte is present in the samples, laboratory corrective action should be taken. If the LCS recovery is higher than the control limit and the samples are ND for the analyte, the data may be accepted.

3.6.2.3 Detectability Check Sample

The laboratory should routinely check the instrument MDL to verify the laboratory's ability to reliably detect the parameter at the MDL that is used for reporting detected results and calculation of non-detected results. The detectability check standard will be checked on a quarterly basis and the results maintained on file with the MDL data.

3.6.2.4 Method Blank

The method blank is analyte-free water or solid material that is processed simultaneously with and under the same conditions as the samples. The method blank is analyzed to demonstrate that the analytical system itself is not contaminated with the analyte(s) being measured. The method blank results should be below the Method Quantitation Limit or corrective action must be taken.

No qualification is warranted if a sample result from the sample group is greater than or equal to five times the associated blank concentration. Analytical results less than five times the associated blank concentration are qualified as non-detected.

3.6.2.5 Additional Method Specific QC Requirements

Additional QC samples may be run (e.g., continuing calibration samples), as specified in the method SOPs. The requirements for these samples, their acceptance criteria, and corrective action are method-specific.

3.6.3 Failures in Quality Control and Corrective Action

All qualified data are evaluated by the RI Manager, in consultation with the QA Manager. In that differences in field duplicate sample results are used to assess the entire sampling process, including environmental variability, the arbitrary rejection of results based on pre-determined limits is not practical. Therefore, the professional judgment of the RI Manager and QA Manager will be relied upon in evaluating results. Rejecting sample results based on wide variability is a possibility. Field blank values exceeding the acceptability criteria may automatically invalidate the sample, especially in cases where high blanks may be indicative of contamination that causes a result to exceed the standard. Field duplicate excursions will be noted. Equipment blank results are also scrutinized very closely. Corrective action will involve identification of the cause of the failure where possible. Response actions may include re-analysis of questionable samples. In some cases, a site may have to be resampled to achieve project goals.

Laboratory measurement quality control failures are evaluated by the Laboratory Project Manager and findings reported to the RI Manager. Specific instances requiring laboratory corrective action are listed in Section 4.1.3.

3.7 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

All sampling equipment testing and maintenance requirements are detailed in the manufacturer's specifications for a particular piece of equipment. Sampling equipment is inspected and tested upon receipt and is verified to be appropriate for use. Field instruments and equipment will be maintained in accordance with the manufacturer's instructions. Field instruments that fail two consecutive calibration requirements will be tagged as "nonfunctional" and returned to the manufacturer for repair or replacement. Acceptance criteria are detailed in the manufacturer's documentation for each instrument.

The equipment testing and maintenance procedures for all laboratory tools, gauges and instruments are documented in the laboratory's QA Manual (Appendix G). Testing and maintenance records are maintained and are available for inspection. Instruments requiring daily or in-use testing may include, but are not limited to: water baths, ovens, autoclaves, incubators, refrigerators, and laboratory pure water. Critical spare parts for essential equipment are maintained or are available through a preferred vendor status to prevent downtime. Maintenance records are available for inspection.

3.8 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY

3.8.1 Field Equipment Calibration

Field equipment calibration requirements are contained in the manufacturer's documentation. All field equipment requiring calibration will be conducted according to the manufacturer's specifications, including tolerance limits and frequencies. Calibration will be conducted daily prior to use. Pre- and post-calibration logs will be kept (or the information provided on standard field records) to insure that equipment has maintained calibration during its use.

3.8.2 Laboratory Equipment Calibration

Detailed laboratory calibration procedures are contained within the specifications and SOPs for each analysis in Appendix G. The laboratory QA Manager identifies all tools, gauges,

instruments, and other sampling, measuring, and testing equipment used for data collection activities affecting quality that must be controlled and, at specified periods must be calibrated to maintain performance within specified limits. Calibration records are maintained and are available for inspection. Equipment requiring periodic calibrations include, but are not limited to, thermometers, pH meters, balances and analytical instruments.

3.9 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

All new batches of field and laboratory supplies are inspected and tested before use to ensure that they are adequate and free of contaminants. Acceptance criteria are detailed in the manufacturer's documentation for the product. The Laboratory Project Manager provides additional details on acceptance requirements for laboratory supplies and consumables. The procurement of purchased items and services that directly affect the quality of environmental projects, shall be planned and controlled to ensure that the quality of the items and services is known, documented, and meets the QAPP requirements and acceptance criteria.

3.10 DATA MANAGEMENT

Data management provides a process for tracing the path of the data from their generation in the field or laboratory to their final use or storage. The following elements are included in this process: recording, validation, transformation, transmittal, reduction, analysis, tracking, and storage and retrieval.

3.10.1 Data Recording

Sample collection will be documented and tracked using field log forms, field logbook entries, and Chain-of-Custody Records. Field personnel will complete these forms, which then will be reviewed for correctness and completeness by the Field Supervisor. Copies of these forms will be maintained in the project files.

3.10.2 Data Validation

Data validation is addressed in Section 5.0 of this QAPP.

3.10.3 Data Transformation

Since data will be collected and/or reported using proper units according to this QAPP, no data transformation is expected. If data transformation is necessary, the transformation procedures will be added to this QAPP.

3.10.4 Data Transmittal

The Field Supervisor will be responsible for assuring that field data are entered onto the appropriate field data forms, and will report any problems to the RI Manager. Field Supervisors will submit the complete field data forms to the RI Manager for review and error checking.

Field Supervisors will also ensure that all samples collected in the field are submitted to the laboratory according to the methods outlined in this QAPP or the FSP. The laboratory will submit to the RI Manager or Field Supervisor the analytical data results in their standard hard-copy format (including raw data format) and in an electronic data deliverable (EDD) format prior to sending the final data report in PDF to the RI Manager. The EDD shall be in space or comma-delimitated ASCII format or in Excel spreadsheet format that will allow for easy integration into a digital database.

Once reviewed by the RI Manager or Field Supervisor for obvious transcription or reporting errors, the final data report in both hard-copy and EDD formats will be transmitted and ready for validation by the QA Manager. Following data validation, any data qualifiers added to data during the validation process will be imported into the project database. Entry or upload of EDDs and data qualifiers into the project database will be completed by a designee of the RI Manager. The data and qualifiers will be initially verified by the individual entering the data. Upon completion of the initial verification step, a report will be generated of the data and verified by the RI Manager against the original data. Only final versions of electronic data will be entered into the database. All electronic data will be verified before and after incorporation into the database against the hard copy reports that accompany the data.

All qualified data will be included with the data packages during all subsequent data transmittal processes. The final hard copy data validation checklists will be included with the data in the

Nature and Extent Data Report (NEDR) and the Preliminary Site Characterization Report (PSCR).

All field forms and lab data will be organized and stored by sample location allowing for easy access if needed. Data can be transferred electronically either on disc, CD, tape or as an email attachment.

3.10.5 Data Analysis

Data analysis will be conducted as described in the RI/FS WP. Applications that may be utilized to analyze the data include Microsoft Excel and Microsoft Access. The results of data analysis for each activity will be presented in the Remedial Investigation Report.

3.10.6 Data Storage and Retrieval

PBW's RI Manager is responsible for project data storage and retrieval. Laboratory data that are stored electronically will be archived electronically, and where printed as part of the paper data report package, will also be archived in paper form. Both the electronic data and hard copies will be maintained in PBW's Round Rock, TX office. In general, all records and data must be retained for a period of 10 years following commencement of construction of any remedial action which is selected following completion of the RI/FS, per Section XX, Paragraph 79 of the UAO. Table 7 shows documents and record types, locations where these records will be housed, retention time and the form of the record.

4.0 ASSESSMENT AND OVERSIGHT ELEMENTS

4.1 ASSESSMENTS AND REPONSE ACTIONS

Table 8 presents types of assessments and response action for data collection activities governed by this QAPP.

4.1.1 Corrective Action

Corrective action is the process of identifying, recommending, approving and implementing measures to counter unacceptable procedures or poor QC performance which can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation and data assessment. All proposed corrective actions should be documented as well as the steps taken to implement the corrective action. Corrective action should only be implemented after approval by the RI Manager or his designee. If immediate corrective action is required, approvals secured by telephone from the RI Manager should be documented.

For noncompliance problems, a formal corrective action program will be developed and implemented at the time the problem is identified. The person who identifies the problem is responsible for notifying the RI Manager. If the problem is related to an analytical procedure affecting the quality of data produced, this information will be promptly communicated to the Analytical Lab Project Manager, the RI Manager and the QA Manager. Implementation of corrective action will be confirmed in writing through the same channels.

Any nonconformance with the established QC procedures will be identified and corrected in accordance with this QAPP. The RI Manager, or his designee, will issue a nonconformance report for each nonconformance condition and include a copy of this report in the project's files.

4.1.2 Field Corrective Action

Corrective action in the field may be needed when the sample program is changed (i.e., more/less samples, sampling locations or frequencies other than those specified in the RI/FS WP or FSP) or

when sampling procedures and/or field procedures require modification due to unexpected conditions. In general, the field team may identify the need for corrective action. The field staff, in conjunction with the field team leader, will recommend a corrective action. The RI Manager will approve the corrective measure, which will be implemented by the field team. It will be the responsibility of the RI Manager to ensure the corrective action has been implemented.

If the corrective action will supplement the RI/FS WP or FSP, using existing and approved procedures in the QAPP, corrective action approved by the RI Manager will be documented. If corrective actions result in less samples, alternate sampling locations, etc., which may cause project QA objectives not to be achieved, it will be necessary that all levels of project management concur with the proposed action.

Corrective action resulting from internal field audits will be implemented immediately if data quality would be adversely affected due to unapproved or improper use of approved methods. The QA Manager will identify deficiencies and recommend corrective action to the RI Manager. Implementation of corrective actions will be performed by the field team under the direction of the RI Manager.

Corrective actions will be documented in the field book. No staff member will initiate corrective action without prior communication of findings through the proper channels. If the actions taken are insufficient to correct the problem identified, work may be stopped by the RI Manager. If at any time a corrective action issue is identified which directly impacts the project objectives, the Project Coordinator will be notified immediately.

4.1.3 Laboratory Corrective Action

Corrective actions in the laboratory may occur prior to, during or after initial analyses. As such, the initial analyses must be performed quickly enough to allow time for reanalysis within the required holding time. A number of conditions, such as broken sample containers, may be identified during sample login or just prior to analysis. The Analytical Laboratory Project Manager will notify the QA Manager of such conditions prior to analysis. Following consultation with lab analysts and section leaders, it may be necessary for the Analytical Laboratory Project

Manager to approve the implementation of corrective action. Some conditions that may trigger corrective action or optional procedures during or after analysis include dilution of samples, sample reanalysis when certain quality control criteria are not met, etc.

Laboratory personnel are alerted that corrective actions may be necessary if:

- QC data are outside the control limits for precision or accuracy;
- Sample results are outside the instrument calibration range;
- Laboratory method blanks contain target analytes above acceptable levels;
- Deficiencies are detected during internal or external audits or from the results of performance evaluation samples; or
- Inquiries concerning data quality are received.

The following specific instances require laboratory corrective action:

- The laboratory method blanks contain target analytes above the MQL and any associated sample contains the analyte at a concentration less than five times that in the blank.
- The LCS recovery is less than 10% for any organic target analyte or 30% for any inorganic analyte.
- The LCS recovery is outside the control limit for more than 1/2 of the target analytes for multi-analyte analyses such as VOC and SVOC.
- The surrogate recovery is less than 10% for any single surrogate.
- The MS recovery is less than 30% for any inorganic analyte.
- The internal standard area is less than 25% (i.e., -75%) of that in the midpoint standard for any single internal standard.

The corrective action shall include reanalyzing (and extracting or digesting, as applicable) the affected samples and/or immediate notification of the QA Manager.

Corrective action procedures are often handled at the bench level by the analyst, who reviews the analytical procedures for possible errors, checks the instrument calibrations and performance, etc.

If the problem persists or cannot be identified, the matter is referred to the laboratory supervisor or Analytical Laboratory Project Manager for further investigation. Once resolved, full documentation of the corrective action procedure is filed. These corrective actions are performed prior to release of the data from the laboratory. All corrective actions associated with sample analyses for this project will be documented and reported in the sample package narrative.

4.1.4 Corrective Action During Data Validation and Data Assessment

The need for corrective action may be identified during either data validation or data assessment. Potential types of corrective action may include resampling, reanalysis of samples, or reprocessing of the sample data. These actions are dependent upon the ability to mobilize the field team and whether the data to be collected are necessary to meet the required QA objectives. If the QA Manager identifies a corrective action situation, it is the RI Manager who will be responsible for approving the implementation of corrective action. All corrective actions of this type will be documented by the QA Manager.

4.2 REPORTS TO MANAGEMENT

4.2.1 Laboratory Data Report

Laboratory data reports contain the results of all specified QC measures listed in Section 2.5.4, including but not limited to equipment blank, filter and reagent blanks, field blanks, laboratory duplicates, laboratory control standards, calibration, and matrix spikes. This information is reviewed by the QA Manager and compared to the pre-specified acceptance criteria to determine acceptability of the data before forwarding to the RI Manager.

4.2.2 Reports to Project Management

The Field Supervisor will report to the RI Manager daily following each field monitoring event. A brief written report will be sent via e-mail to the RI Manager that documents any problems, delays, or corrective actions that may be required or that may affect the subsequent sampling

efforts. The report will also include a brief synopsis of the work conducted during the field monitoring event.

5.0 DATA VALIDATION AND USABILITY

5.1 INTRODUCTION

Data are conventionally placed into one of five different levels (EPA, 1988), depending on the intended use of the data. These five analytical levels, the applicable data uses, and examples of the type of data are shown in the following table:

ANALYTICAL LEVEL	DATA USES	EXAMPLES
Level 1	Site Characterization Monitoring during implementation	Portable instruments Field test kits
Level 2	Site Characterization Evaluation of Alternatives Engineering Design Monitoring during Implementation	Organics by gas chromatography (GC) Inorganics by atomic adsorption (AA) Inorganics by X-ray diffraction
Level 3	Risk Assessment PRP Determination Site Characterization Evaluation of Alternatives Engineering Design Monitoring during Implementation	Analysis using analyte-specific EPA procedures, other than CLP
Level 4	Risk Assessment PRP Determination Evaluation of Alternatives Engineering Design	Organics/Inorganics by GC/MS, AA, ICP CLP analyses
Level 5	Risk Assessment PRP Determination	Non-conventional parameters Modified methods Appendix 8 Parameters

Standard data review levels, which have originated from the analytical levels, are defined as follows:

DATA REVIEW LEVEL	DATA USES	ITEMS VALIDATED	OBJECTIVE
Level 2	Site Characterization Evaluation of Alternatives Engineering Design Monitoring during Implementation	General Performance Data such as Sample Preservation and Holding Time; Field and Laboratory Blanks; and Laboratory and Matrix Spikes	Assess technical validity
Level 3	Risk Assessment PRP Determination Site Characterization Evaluation of Alternatives Engineering Design Monitoring during Implementation	General Performance Data plus Instrument Performance Data such as Initial Calibration, Continuing Calibration Verification, and Interference Checks	Assess technical validity Provide legal defensibility

Level 4	Risk Assessment PRP Determination Evaluation of Alternatives Engineering Design	General Performance Data, Instrument Performance Data, and Analyte Identification and Quantitation (raw data review)	Assess technical validity Provide legal defensibility Address data integrity

5.2 DATA REVIEW: VERIFICATION, VALIDATION, AND INTEGRITY

For the purpose of this document, verification means the processes taken to determine compliance of data with project requirements, including documentation and technical criteria. Validation means those processes taken independently of the data-generation processes to determine the usability of data for its intended use(s). Integrity means the processes taken to assure that no falsified data will be reported.

All data obtained from field and laboratory measurements will be reviewed and verified for conformance to project requirements, and then validated against the project objectives that are listed in Section 2.4. Data supported by appropriate quality control results that meet the project objectives defined for this project will be considered acceptable without qualification. Data associated with quality control results that do not meet the project objectives defined for this project will be assigned appropriate qualifiers reflecting the potential impact on data usability. Analytical data will be considered usable unless rejected during the validation process.

The procedures for verification and validation of data are described in Section 5.3, below. The Field Supervisor is responsible for ensuring that field data are properly reviewed and verified for integrity by reviewing field equipment calibration records and verifying proper field procedures. The Analytical Lab Project Manager is responsible for ensuring that laboratory data are scientifically valid, defensible, of acceptable precision and accuracy, and reviewed for integrity and indicates this by signing the data package Narrative. The QA Manager will be responsible for ensuring that all laboratory data are properly reviewed and verified, and submitted in the required format to the project database. The QA Manager is responsible for validating the laboratory data and documenting the review. Finally, the RI Manager, with the concurrence of the QA Manager, is responsible for verifying that all data to be reported meet the objectives of the project and are suitable for reporting.

5.3 VERIFICATION AND VALIDATION METHODS

All data will be verified to ensure they are representative of the samples analyzed and locations where measurements were made, and that the sample results and associated quality control data conform to project specifications. The staff and management of the respective field, laboratory, and data management tasks are responsible for the integrity, validation and verification of the data each task generates or handles throughout each process. The field and laboratory tasks ensure the verification of raw data, electronically generated data, and information on COC forms and hard copy output from instruments. The Analytical Lab Project Manager will document the review of the reported data per the laboratory's QA Plan.

Verification, validation and integrity review of all laboratory data will be performed or supervised by the QA Manager. The data to be verified are evaluated against project specifications (Section 2.4) and are checked for errors, especially errors in transcription, calculations, and data input. The QA Manager will validate all reported laboratory data in accordance with the project Data Validation Standard Operating Procedure (SOP No. 16) (Appendix F). All laboratory data will be validated using a Level III data review. For critical samples, such as tissue analysis for human health risk assessment, a Level IV review may be instituted. The level of data review established for each media/activity is included in Appendices A-E. The validation will be documented on the Validation Checklist included in the SOP and data qualifiers will be added to the database as appropriate. The SOP includes guidelines for applying data qualifiers. Generally, data will be rejected for use if the holding time is grossly exceeded or the QC data indicates an extremely low bias (<10% true value) in the measurement.

Potential outliers are identified by the QA Manager and RI Manager by examining results for unreasonable data, or identified using computer-based statistical software. If a question arises or an error or potential outlier is identified, the Field Supervisor or the Analytical Lab Project Manager responsible for generating the data is contacted to resolve the issue. Issues that can be corrected are corrected and documented electronically or by initialing and dating the associated paperwork. If an issue cannot be corrected, the QA Manager and/or the RI Manager will determine the appropriate course of action, or the data associated with the issue are rejected.

The RI Manager and QA Manager are each responsible for validating that the verified data are scientifically valid, defensible, of known precision, accuracy, integrity, meet the project objectives of the project, and are reportable. One element of the validation process involves evaluating the data again for anomalies. The QA Manager or RI Manager may designate other experts familiar with the project to perform this evaluation. Any suspected errors or anomalous data must be addressed by the manager of the task associated with the data before data validation can be completed.

5.4 RECONCILIATION WITH USER REQUIREMENTS

The data collected pursuant to this QAPP will be evaluated to see whether it supports the project objectives (Table 6). Statistical evaluations may be performed on some data sets, as outlined in the RI/FS WP. The results of data evaluation, including limitations of the use of the data, will be presented in the RI Report.

6.0 REFERENCES

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TABLES

TABLE 1 - SOILS/SEDIMENT DATA QUALITY OBJECTIVES

Conceptual Site Model Exposure Route[(1)]	**Inhalation of particulates in ambient air resulting from fugitive dust generation and/or contact with/ingestion of particles deposited on surface soil.**	**Ingestion of and dermal contact with sediments as a result of surface runoff of Chemicals of Interest (COIs) from Potential Source Areas (PSAs). Exposure to soil via ingestion and dermal contact.**	**Ingestion of fish potentially containing COIs as a result of surface runoff of COIs from PSAs to surface water/sediments from PSAs and uptake by fish.**
1. State the problem	*Conduct a site investigation and assess the potential risks posed by releases of chemicals associated with the Site, and develop remedial alternatives to address any unacceptable risks.*		
2. Identify the Decision	Do COIs in surface soil pose an unacceptable risk through fugitive dust emissions and/or airborne transport to off-site areas?	Do COIs in soil and/or sediments pose an unacceptable risk to human health or ecological receptors through ingestion or dermal contact with the surface soil?	Do COIs in soil pose an unacceptable risk via runoff to surface water/sediments and uptake by fish?
3. Identify inputs to the decision	• Evaluate existing Site soil data. • Evaluate background COI concentrations in soil. • Collect soil samples as described in the RI/FS Work Plan and Field Sampling Plan. • Measure COI in surface soil samples collected. • Validate analytical data. • QA/QC samples: Collect 1 field duplicate and 1 MS/MSD sample per 20 samples for COI analyses. • Analytical method detection limit targets are provided in Appendix A for soil.	• Evaluate existing Site soil and sediment data. • Evaluate background COI concentrations. • Collect soil and sediment samples as described in the RI/FS Work Plan and Field Sampling Plan. • Measure COIs in soil and sediment samples collected. • Validate analytical data. • QA/QC samples: Collect 1 field duplicate and 1 MS/MSD sample per 20 samples for COI analyses. • Analytical method detection limit targets are provided in Appendix A for soil and Appendix D for sediment.	• Evaluate existing Site soil and sediment data. • Evaluate background concentrations. • Collect soil and sediment samples as described in the RI/FS Work Plan and Field Sampling Plan. • Measure COIs in soil and sediment samples collected. • Validate analytical data. • QA/QC samples: Collect 1 field duplicate and 1 MS/MSD sample per 20 samples for COI analyses. • Analytical method detection limit targets are provided in Appendix A for soil and Appendix D for sediment.

TABLE 1 - SOILS/SEDIMENT DATA QUALITY OBJECTIVES

Conceptual Site Model Exposure Route[(1)]	**Inhalation of particulates in ambient air resulting from fugitive dust generation and/or contact with/ingestion of particles deposited on surface soil.**	**Ingestion of and dermal contact with sediments as a result of surface runoff of Chemicals of Interest (COIs) from Potential Source Areas (PSAs). Exposure to soil via ingestion and dermal contact.**	**Ingestion of fish potentially containing COIs as a result of surface runoff of COIs from PSAs to surface water/sediments from PSAs and uptake by fish.**
4. Define boundaries of the study	• The horizontal boundaries are the lateral extents of contamination as determined by the Preliminary Screening Value (PSV) comparisons described in the RI/FS Work Plan (PBW, 2006a). In addition background soil samples may be collected from a designated area approximately 2,000 feet northeast of the Site. • The vertical boundaries are the vertical extents of contamination as determined by the PSV comparisons described in the RI/FS Work Plan. • The temporal boundary is the initial RI sampling to occur in 2006 and 2007.	• The horizontal boundaries are the lateral extents of contamination as determined by the PSV comparisons described in the RI/FS Work Plan. In addition background soil samples may be collected from a designated area approximately 2,000 feet northeast of the Site. Background sediment samples will be collected from a designated location approximately 1.5 miles east of the Site. • The vertical boundaries are the vertical extents of contamination as determined by the PSV comparisons described in the RI/FS Work Plan. • The temporal boundary is the initial RI sampling to occur in 2006 and 2007.	• The horizontal boundaries are the lateral extents of contamination as determined by the PSV comparisons described in the RI/FS Work Plan. In addition background soil samples may be collected from a designated area approximately 2,000 feet northeast of the Site. Background sediment samples will be collected from a designated location approximately 1.5 miles east of the Site. • The vertical boundaries are the vertical extents of contamination as determined by the PSV comparisons described in the RI/FS Work Plan. • The temporal boundary is the initial RI sampling to occur in 2006 and 2007.
5. Develop a decision rule	If COIs exceed the PSVs for soil, then those COI soil data will be quantitatively evaluated in the BHHRA. Additional delineation may be necessary.	If COIs exceed the PSVs for soil or sediment, then those COI soil/sediment data will be quantitatively evaluated in the BHHRA. Additional off-site delineation may be necessary.	If COIs exceed the PSVs for soil or sediment, then those COI soil/sediment data will be quantitatively evaluated in the BHHRA. Additional off-site delineation may be necessary.
6. Specify limits on decision errors	Precision criteria for use of measurement data are defined in Section 2.4.2 and Appendix A for soil (QAPP).	Precision criteria for use of measurement data are defined in Section 2.4.2 and Appendix A for soil and Appendix D for sediment (QAPP).	Precision criteria for use of measurement data are defined in Section 2.4.2 and Appendix A for soil and Appendix D for sediment (QAPP).

TABLE 1 - SOILS/SEDIMENT DATA QUALITY OBJECTIVES

Conceptual Site Model Exposure Route[(1)]	**Inhalation of particulates in ambient air resulting from fugitive dust generation and/or contact with/ingestion of particles deposited on surface soil.**	**Ingestion of and dermal contact with sediments as a result of surface runoff of Chemicals of Interest (COIs) from Potential Source Areas (PSAs). Exposure to soil via ingestion and dermal contact.**	**Ingestion of fish potentially containing COIs as a result of surface runoff of COIs from PSAs to surface water/sediments from PSAs and uptake by fish.**
7. Optimize design for obtaining data	The number of samples (random and judgmental) for the RI/FS investigation has been selected to provide a dataset size that is adequate for meaningful analysis. The sampling design is expected to provide adequate characterization of the media. However, additional sampling may be needed based on the results of the initial RI sampling event.	The number of samples (random and judgmental) for the RI/FS investigation has been selected to provide a dataset size that is adequate for meaningful analysis. The sampling design is expected to provide adequate characterization of the media. However, additional sampling may be needed based on the results of the initial RI sampling event.	The number of samples (random and judgmental) for the RI/FS investigation has been selected to provide a dataset size that is adequate for meaningful analysis. The sampling design is expected to provide adequate characterization of the media. However, additional sampling may be needed based on the results of the initial RI sampling event.

Notes:
1. See Figures 7 – 10 of RI/FS Work Plan for more detailed descriptions of exposure routes.

TABLE 2 – GROUNDWATER DATA QUALITY OBJECTIVES

Conceptual Site Model Exposure Route[(1)]	**Inhalation of vapors that have migrated from groundwater through the soil pore space and into ambient air.**	**Exposure to potable water through ingestion, dermal contact, ingestion of crops that were irrigated with water, and inhalation of vapors emitted from water as a result of COI leaching to groundwater.**
1. State the problem	*Conduct a site investigation to evaluate the lateral and vertical extent of potential NAPL and the potential risks from ingestion of groundwater downgradient of the Site; develop remedial alternatives to address any unacceptable risks.*	
2. Identify the Decision	Do COIs in groundwater or NAPL at the Site pose an unacceptable risk through inhalation of vapors from groundwater?	Have COIs in groundwater NAPL migrated downgradient of the Site to pose an acceptable risk through ingestion of groundwater?
3. Identify inputs to the decision	• Evaluate existing Site groundwater data. • Collect groundwater samples from and evaluate presence of NAPL in temporary well points and permanent wells on Site. • Develop estimates of hydraulic conductivity and saturated thickness measurements at well locations. • Use water level data from the existing monitoring well locations and RI monitoring wells to prepare a potentiometric map (groundwater flow direction and hydraulic gradient). • Evaluate stratigraphic data for NAPL migration. • Measure COIs in groundwater samples collected. • Validate analytical data. • QA/QC samples: Collect 1 field duplicate and 1 MS/MSD sample per 20 samples for COI analyses. • Analytical method detection limit targets for groundwater are provided in Appendix B.	<u>Physical completeness of exposure pathway</u> • Evaluate status of domestic/residential/public supply wells entered into governmental water well databases and perform field survey in Site vicinity. • Review area zoning restrictions for private wells (i.e., water provided by city). <u>Presence of COIs in groundwater at concentrations that pose potential risk</u> • Collect groundwater samples from and evaluate presence of NAPL in temporary well points and permanent wells on Site. • Develop estimates of hydraulic conductivity and saturated thickness measurements at well locations. • Use water level data from the existing monitoring well locations and RI monitoring wells to prepare a potentiometric map (groundwater flow direction and hydraulic gradient). • Evaluate stratigraphic data for NAPL migration. • Evaluate classification of groundwater beneath and downgradient of the Site • Measure COIs in groundwater samples collected. • Validate analytical data. • QA/QC samples: Collect 1 field duplicate and 1 MS/MSD sample per 20 samples for COI analyses. • Analytical method detection limit targets for groundwater are provided in Appendix B.

TABLE 2 – GROUNDWATER DATA QUALITY OBJECTIVES

Conceptual Site Model Exposure Route[(1)]	**Inhalation of vapors that have migrated from groundwater through the soil pore space and into ambient air.**	**Exposure to potable water through ingestion, dermal contact, ingestion of crops that were irrigated with water, and inhalation of vapors emitted from water as a result of COI leaching to groundwater.**
4. Define boundaries of the study	• The horizontal boundaries are the lateral extents of contamination as determined by the PSV comparisons described in the RI/FS Work Plan. • The vertical boundary for groundwater is the base of the uppermost water-bearing unit in which COI concentrations are reported above PSVs. • The temporal boundary is the initial RI sampling to occur in 2006 and 2007.	• The horizontal boundaries are the lateral extents of contamination as determined by the PSV comparisons described in the RI/FS Work Plan. • The vertical boundary for groundwater is the base of the uppermost water-bearing unit in which COI concentrations are reported above PSVs. • The temporal boundary is the initial RI sampling to occur in 2006 and 2007.
5. Develop a decision rule	If COIs exceed the PSVs for inhalation from groundwater through soil, then those COI groundwater data will be quantitatively evaluated in the BHHRA.	If COIs exceed the PSVs for groundwater at the property boundary, or if NAPL is present, then additional off-site delineation will be necessary.
6. Specify limits on decision errors	Precision criteria for use of measurement data are defined in Section 2.4.2 and Appendix B for groundwater.	Precision criteria for use of measurement data are defined in Section 2.4.2 and Appendix B for groundwater.
7. Optimize design for obtaining data	The number of samples for the RI/FS investigation has been selected to provide a dataset size that is adequate for meaningful analysis. The sampling design is expected to provide adequate characterization of the media. However, additional sampling may be needed based on the results of the initial RI sampling event.	The number of samples for the RI/FS investigation has been selected to provide a dataset size that is adequate for meaningful analysis. The sampling design is expected to provide adequate characterization of the media. However, additional sampling may be needed based on the results of the initial RI sampling event.

Notes:
1. See Figures 7 – 10 of RI/FS Work Plan for more detailed descriptions of exposure routes.

TABLE 4 - FISH TISSUE DATA QUALITY OBJECTIVES

Conceptual Site Model Exposure Route[(1)]	**Ingestion of finfish and crabs from the Intracoastal Waterway near the Site.**
1. State the problem	*Conduct a site investigation to evaluate if commonly consumed species of finfish and crabs in the vicinity of the Site have been impacted by COIs at the Site such that they pose an unacceptable risk to potential receptors through consumption.*
2. Identify the Decision	Do COIs present in sediments as a result of Site operations pose an unacceptable risk to potential receptors?
3. Identify inputs to the decision	• Collect nine samples from three finfish species (legal size limit) commonly caught in the area and consumed; and nine samples from blue crabs caught in the vicinity of the Site. • Measure COIs in fish tissue samples collected (COIs, excluding essential nutrients, detected above sample quantitation limits (SQLs) and background in the sediment samples will determine the list of COIs to be analyzed in fish tissue samples). • Validate the analytical data. • If warranted, analyze background fish tissue samples for selected COIs reported in Site fish tissue samples. • QA/QC samples: Collect 1 field duplicate and 1 MS/MSD sample per species for COI analyses. • Analytical method detection limit targets will be identified following Intracoastal Waterway sediment sampling.
4. Define boundaries of the study	• The horizontal boundaries are the Site property boundaries (east and west) as extended to the adjacent Intracoastal Waterway. Background samples will be collected from a designated area approximately 1.5 miles east of the Site. • No vertical boundaries – fish may be sampled from any depth. . • The temporal boundary is the initial RI sampling to occur in 2007.
5. Develop a decision rule	If COIs are detected in fish tissue, then those data will be quantitatively evaluated in the BHHRA.
6. Specify limits on decision errors	Precision criteria for use of measurement data are defined in Section 2.4.2. Specific limits will be established following the Intracoastal Waterway sediment sampling results.
7. Optimize design for obtaining data	A single species of red drum, spotted seatrout, and southern flounder (within the legal size limits) will provide a sufficient quantity for analyses. Edible tissue from five adult blue crabs will need to be collected for sufficient sample quantity.

Notes:
1. See Figures 7 – 10 of RI/FS Work Plan for more detailed descriptions of exposure routes.

TABLE 3 - SURFACE WATER DATA QUALITY OBJECTIVES

Conceptual Site Model Exposure Route[(1)]	**Exposure via contact with surface water, and inhalation of vapors emitted from surface water as a result of surface runoff of COIs from PSAs.**	**Exposure via contact with surface water, and inhalation of vapors emitted from surface water as a result of COI leaching to groundwater, groundwater discharge to surface water.**
1. State the problem	*Conduct a site investigation to evaluate the lateral extent of COIs in surface water in the wetlands in the North Area, in ponds on the Site, and in the Intracoastal Waterway to evaluate potential risks posed by releases of chemicals associated with the Site, and develop remedial alternatives to address any unacceptable risks.*	
2. Identify the Decision	• Do COIs in wetland, pond, and Intracoastal Waterway surface water pose an unacceptable risk to potential receptors?	• Do COIs in wetland, pond, and Intracoastal Waterway surface water pose an unacceptable risk to potential receptors?
3. Identify inputs to the decision	• Evaluate existing Site surface water data. • Collect surface water samples as described in the RI/FS Work Plan and Field Sampling Plan. • Measure COIs in surface water samples collected. • Validate analytical data. • QA/QC samples: Collect 1 field duplicate and 1 MS/MSD sample per 20 samples for COI analyses. • Analytical method detection limit targets for surface water are provided in Appendix C.	• Evaluate existing Site surface water data. • Collect surface water samples as described in the RI/FS Work Plan and Field Sampling Plan. • Measure COIs in surface water samples collected. • Validate analytical data. • QA/QC samples: Collect 1 field duplicate and 1 MS/MSD sample per 20 samples for COI analyses. • Analytical method detection limit targets for surface water are provided in Appendix C.
4. Define boundaries of the study	• The horizontal boundaries are the lateral extents of contamination as determined by the PSV comparisons described in the RI/FS Work Plan. • The vertical boundary for surface water samples is the bottom depth of the water body. • The temporal boundary is the initial RI sampling to occur in 2006 and 2007.	• The horizontal boundaries are the lateral extents of contamination as determined by the PSV comparisons described in the RI/FS Work Plan. • The vertical boundary for surface water samples is the bottom depth of the water body. • The temporal boundary is the initial RI sampling to occur in 2006 and 2007.

TABLE 3 - SURFACE WATER DATA QUALITY OBJECTIVES

Conceptual Site Model Exposure Route[(1)]	**Exposure via contact with surface water, and inhalation of vapors emitted from surface water as a result of surface runoff of COIs from PSAs.**	**Exposure via contact with surface water, and inhalation of vapors emitted from surface water as a result of COI leaching to groundwater, groundwater discharge to surface water.**
5. Develop a decision rule	• If COIs exceed the PSVs for surface water, then those COI surface water data will be quantitatively evaluated in the BHHRA. Additional delineation may be necessary.	• If COIs exceed the PSVs for surface water, then those COI surface water data will quantitatively evaluated in the BHHRA. Additional delineation may be necessary.
6. Specify limits on decision errors	Precision criteria for use of measurement data are defined in Section 2.4.2 and Appendix C for surface water.	Precision criteria for use of measurement data are defined in Section 2.4.2 and Appendix C for surface water.
7. Optimize design for obtaining data	The number of surface water samples has been selected to provide a dataset that is adequate for meaningful analysis. The sampling design is expected to provide adequate characterization of the media. However, additional sampling may be needed based on the results of the initial RI sampling event.	The number of surface water samples has been selected to provide a dataset that is adequate for meaningful analysis. The sampling design is expected to provide adequate characterization of the media. However, additional sampling may be needed based on the results of the initial RI sampling event.

Notes:

1. See Figures 7 - 10 of RI/FS Work Plan for more detailed descriptions of exposure routes.

TABLE 5 - GEOTECHNICAL DATA QUALITY OBJECTIVES

Conceptual Site Model Exposure Route[(1)]	**Inhalation of volatile organic compounds (VOCs) volatilized to air from residual wastes in former surface impoundments.**
1. State the problem	*Assess the construction and current condition of the cap/cover at the former surface impoundments.*
2. Identify the Decision	• Is the cap/cover construction and current condition adequate to sufficiently restrict the movement of volatile organic compounds (VOCs) from travel through the cap/cover to outdoor air?
3. Identify inputs to the decision	• Collect samples of the cap material (four soil borings) to 5 feet below ground surface or until the base of the cap material is encountered in the borings. • Perform geotechnical tests (percent passing No. 200 sieve, Atterburg Limits, vertical hydraulic conductivity) on the samples collected. • Collect and document field observations of desiccation cracks, erosion features, and overall surface conditions.
4. Define boundaries of the study	• The horizontal boundaries are the extents of the former impoundment cap/cover • The vertical boundary for surface soil is 5 feet below ground surface, or to the base of the cap/cover material. • The temporal boundary is the initial RI sampling to be conducted in 2006 and 2007.
5. Develop a decision rule	If the existing cap/cover construction and/or condition is judged to be insufficient based on geotechnical data and field inspection, then a more detailed evaluation of potential volatilization of VOCs through the cap may be necessary.
6. Specify limits on decision errors	Precision criteria for use of measurement data are defined in Section 2.4.2 and Appendix A for soil.
7. Optimize design for obtaining data	Four soil borings, in addition to a field inspection of the cap/cover, will provide sufficient data to characterize the former impoundment cap/cover.

Notes:
1. See Figures 7 - 10 of RI/FS Work Plan for more detailed descriptions of exposure routes.

TABLE 6 – PROJECT OBJECTIVES SUMMARY

Media	Chemicals of Interest (COI)	Location	Objective
Soil	VOC, SVOC, Pesticides, PCB, Metals	• Potential Source Areas (PSA) – Former AST Tank Farm, Pipelines, Former Surface Impoundment Area, Former Wash Water Storage Tank Area, Sand Blasting Areas, Welding Area, Dry Dock Area, Surface Drainage Areas, Former Septic Tank Areas, Former Product Storage Tank Area, Former Gasoline Storage Tank Area	• Nature and extent of contamination • Quantitative risk assessment - human health and ecological
Soil	PCB	• PSA - Former Electrical Shed	• Nature and extent of contamination • Quantitative risk assessment - human health and ecological
Soil	Metals	• PSA - Lot 21 Area (top 1-inch) • Lots 19 and 20 west of Site (top 1-inch) • Residential Properties west of Snapper Lane (top 1-inch)	• Nature and extent of contamination • Quantitative risk assessment - human health
Soil	VOC, SVOC, Pesticides, PCB, Metals	• Site-wide grid sampling(1)	• Nature and extent of contamination • Quantitative risk assessment - human health and ecological
Sediment	VOC, SVOC, Pesticides, PCB, Metals	• Wetlands Area • On-site Ponds • Intracoastal Waterway	• Nature and extent of contamination • Quantitative risk assessment - human health and ecological
Sediment	VOC, SVOC, Pesticides, PCB, Metals	• Site-wide grid sampling	• Investigate possibility of additional Potential Source Areas • Nature and extent of contamination • Quantitative risk assessment - human health and ecological
Ground-water	VOC, SVOC, Pesticides, PCB, Metals	• PSAs - Former AST Tank Farm, Pipelines, Former Surface Impoundment Area, Former Wash Water Storage Tank Area, Sand Blasting Areas, Dry Dock Area, Surface Drainage Areas, Former Septic Tank Areas, Former Product Storage Tank Area, Lot 21 Area • Site Perimeter • Wetlands Area	• Nature and extent of contamination • Quantitative risk assessment - human health

TABLE 6 – PROJECT OBJECTIVES SUMMARY

Media	Chemicals of Interest (COI)	Location	Objective
Surface Water	VOC, SVOC, Pesticides, PCB, Metals	• On-Site Ponds • Wetlands Area • Intracoastal Waterway	• Quantitative risk assessment - human health and ecological
Fish Tissue	To be determined based on Sediment data.	• Intracoastal Waterway	• Quantitative risk assessment - human health
NAPL	VOC, SVOC, Pesticides	Locations where NAPL is found (if any)	• Quantitative risk assessment - human health and ecological

Notes:

1. Sediment samples will be collected from areas that are considered wetlands and soil samples from other areas.

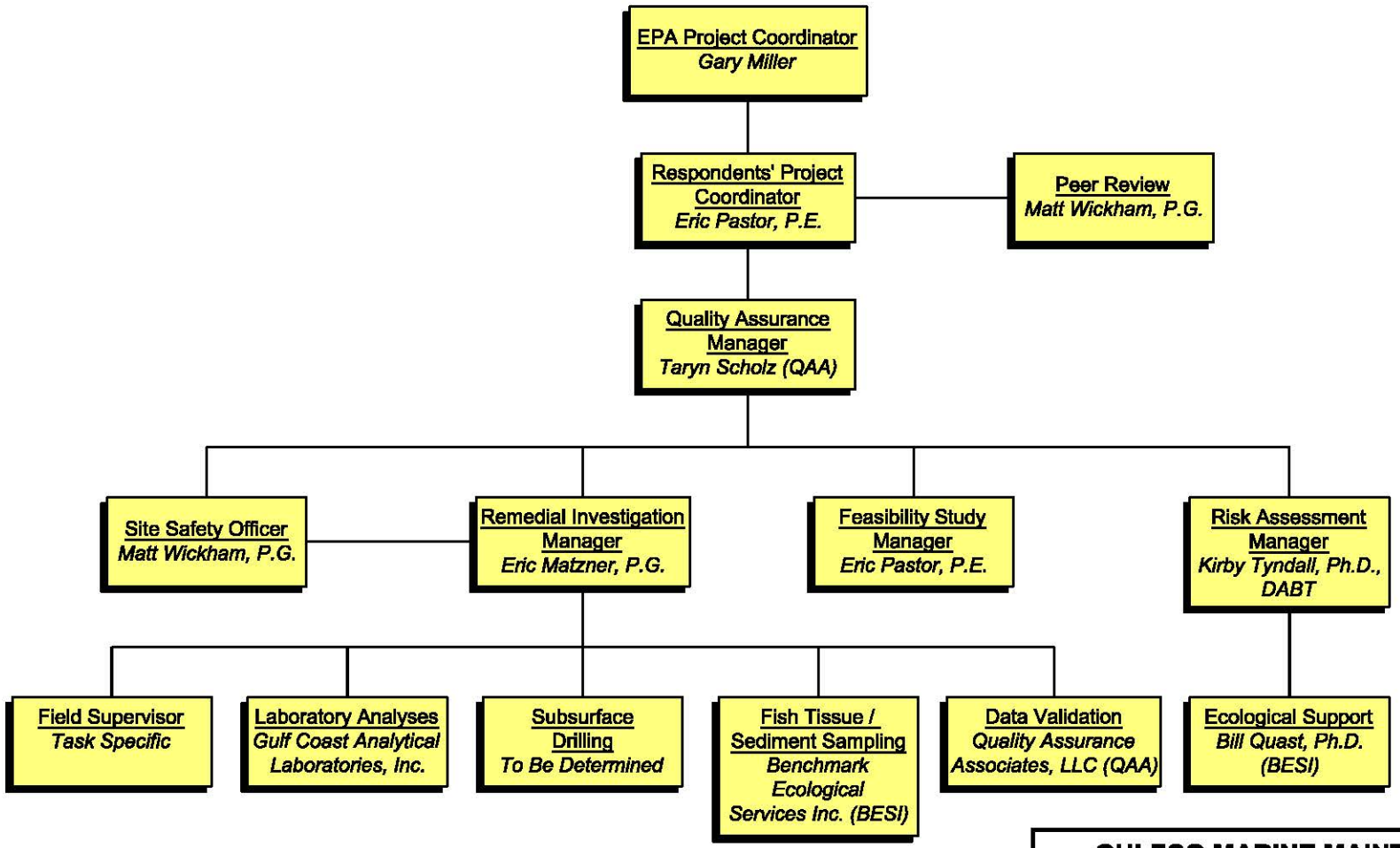
TABLE 7 - DOCUMENT AND RECORD RETENTION

Record	Type	Retention Period	Archival Location	Disposition
Field Records – field data sheets, field notebooks, Chains-of -Custody, etc.	Paper	Until 10 years following commencement of construction of any remedial action which is selected following completion of the RI/FS.	In Pastor, Behling & Wheeler, LLC (PBW) files.	After retention period, Respondents will notify EPA at least 90 days before documents are scheduled to be destroyed. If EPA requests that documents be saved, Respondents will give documents or copies of documents to EPA per Section XX, Paragraph 79 of the modified Unilateral Administrative Order (UAO).
Laboratory records – sample receipt and storage logs, COCs, sample preparation records, instrument performance records, raw data files, etc.	Paper, Electronic	Until 10 years following commencement of construction of any remedial action which is selected following completion of the RI/FS.	In laboratory files during duration of project; to PBW files for remainder of retention period	After retention period, Respondents will notify EPA at least 90 days before documents are scheduled to be destroyed. If EPA requests that documents be saved, Respondents will give documents or copies of documents to EPA per the modified UAO.

TABLE 8 - ASSESSMENTS AND RESPONSE ACTIONS

Assessment Activity	Approximate Schedule	Responsible Party	Scope	Response Requirements
Status Monitoring, Oversight, etc.	Continuous	Respondents' Project Coordinator	Monitoring of the project status and records to ensure requirements are being fulfilled.	Report to Respondents. Ensure project requirements are being fulfilled.
Monitoring Systems Audits	Daily during field sampling activities	Field Supervisor	Field sampling, handling and measurement; and data management as they relate to this project.	Immediate response to RI Manager to address corrective actions.
Laboratory Monitoring	Following data reporting	Quality Assurance Manager	Record keeping, sample handling and data reporting	Response in writing to Respondents' Project Coordinator to address corrective actions.

FIGURES



GULFCO MARINE MAINTENANCE
FREEPORT, BRAZORIA COUNTY, TEXAS

Figure 1

PROJECT ORGANIZATION

PROJECT: 1259	BY: ZGK	REVISIONS
DATE: FEB., 2006	CHECKED: EFP	

PASTOR, BEHLING & WHEELER, LLC
CONSULTING ENGINEERS AND SCIENTISTS

APPENDIX A

QA/QC INFORMATION - SOIL

TABLE A-1 - PARAMETERS AND METHOD SPECIFICATIONS

MEDIA: SOIL

Intended Use: Investigate possibility of additional Potential Source Areas
Nature and extent of contamination
Quantitative risk assessment - human health and ecological

QC Level: Level III with Level IV for 10% of the sample sets (selected by RI Manager with consideration given to sample results, location and matrix)

Laboratory Parameters	Sampling SOP	Measurement Technique	Preparation Method	Analysis Method
Chemical Analyses				
Metals	PBW-SOP-5	ICP-AES	SW846 3050B	SW846 6010B
Chromium VI	PBW-SOP-5	Colorimetric	SW846 3060A	SW846 7196A
Mercury	PBW-SOP-5	Cold Vapor AA	SW846 7471A	SW846 7471A
Organochlorine Pesticides	PBW-SOP-5	GC	SW846 3550B cleanup (e.g., 3620B) as needed	SW846 8081A
PCBs	PBW-SOP-5	GC	SW846 3550B cleanup (e.g., 3665A) as needed	SW846 8082
VOCs	PBW-SOP-5	GC/MS	SW846 5035	SW846 8260B
SVOCs	PBW-SOP-5	GC/MS	SW846 3550B cleanup (e.g., 3640A) as needed	SW846 8270C
Moisture Content	PBW-SOP-5	Gravimetric	NA	SM 2540G
Total Organic Carbon	PBW-SOP-5	NA	NA	SW846 415.1/9060
Soil Bulk Density	PBW-SOP-5	NA	NA	ASTM D2937
pH	PBW-SOP-5	NA	NA	SW-846 9045
Geotechnical Analyses[(1)]				
Percent Passing No. 200 Sieve Analysis	PBW-SOP-5	NA	NA	ASTM D1140
Atterburg Limits	PBW-SOP-5	NA	NA	ASTM 4318
Vertical Hydraulic Conductivity	PBW-SOP-5	NA	NA	COE EM-1110-2-1906

NOTES:
1. Analyses only performed on Former Impoundment Cap samples.

TABLE A-2 - SAMPLE CONTAINER, PRESERVATION AND HOLDING TIME REQUIREMENTS

MEDIA: SOIL

Laboratory Parameters	Container	Preservation	Holding Time
Chemical Analyses			
Metals	P, G	Cool to 4 C	6 months
Chromium VI	P, G	Cool to 4 C	30 days (preparation) 4 days (analysis)
Mercury	P, G	Cool to 4 C	28 days
Organochlorine Pesticides	G-TLC	Cool to 4 C	14 days (preparation) 40 days (analysis)
PCBs	G-TLC	Cool to 4 C	14 days (preparation) 40 days (analysis)
VOCs[1]	G-TLS or G-TLC	Cool to 4 C	14 days
SVOCs	G-TLC	Cool to 4 C	14 days (preparation) 40 days (analysis)
Moisture Content	P, G	Cool to 4 C	NA
Total Organic Carbon	G-TLC	Cool to 4 C	28 days
Soil Bulk Density	P, G	Cool to 4 C	NA
pH	P, G	Cool to 4 C	Immediately upon receipt

P – Polyethylene G – Glass TLC – Teflon®-lined cap TLS – Teflon®-lined septum

Notes:
1. Samples shall not contain headspace. Solid samples collected in EnCore samplers must be transferred to a soil sample vial within 48 hours.

TABLE A-3 - FIELD QUALITY CONTROL SAMPLE REQUIREMENTS

MEDIA: SOIL

Laboratory Parameters	Trip Blanks	Equipment/ Field Blanks	Field Duplicates[(1)]	Matrix Spikes/ Matrix Spike Duplicates[(1)]
Metals	NA	1 per day	1 per 20 samples	1 per 20 samples[(2)]
Chromium VI	NA	1 per day	1 per 20 samples	1 per 20 samples[(2)]
Mercury	NA	1 per day	1 per 20 samples	1 per 20 samples[(2)]
Organochlorine Pesticides	NA	1 per day	1 per 20 samples	1 per 20 samples
PCBs	NA	1 per day	1 per 20 samples	1 per 20 samples
VOCs	1 per cooler	1 per day	1 per 20 samples	1 per 20 samples
SVOCs	NA	1 per day	1 per 20 samples	1 per 20 samples

Notes:
1. Frequency is one per twenty samples or one per day, whichever is greater.
2. An analytical duplicate (i.e., unspiked) may be substituted for the matrix spike duplicate.

TABLE A-4 - QUALITY CONTROL OBJECTIVES
MEDIA: SOIL

Analyte	Method[1]	Target MDL[2] (mg/Kg)	Target MQL[3] (mg/Kg)	Max %RSD[4]	Min r (Correl. Coeff)	CCV[5] REC.	Blank Conc. [6]	LCS MS/MSD REC.[7]	Analytical Dup RPD	Field Dup RPD	SU REC.[7]	IS Area[8]
Total Moisture	Std Methods 2540 G	0.01	0.01	NA	NA	NA	NA	NA	30	NA	NA	NA
Chloride	9251	3.3	10	NA	NA	70-130	<MQL	70-130	30	NA	NA	NA
Sulfate	9038	17	50	NA	NA	70-130	<MQL	70-130	30	NA	NA	NA
Chromium (VI)	7196A	0.67	2	NA	NA	70-130	<MQL	70-130	30	50	NA	NA
ICP metals												
Aluminum	6010B	2.7	8	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Antimony	6010B	0.33	2.4	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Arsenic	6010B	0.53	1.6	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Barium	6010B	0.33	1	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Beryllium	6010B	0.07	0.2	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Boron	6010B	1.1	4	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Cadmium	6010B	0.07	0.2	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Cobalt	6010B	0.13	0.4	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Copper	6010B	0.13	0.4	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Iron	6010B	1.3	4	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Lead	6010B	0.2	0.6	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Lithium	6010B	0.67	2	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Manganese	6010B	0.2	0.6	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Nickel	6010B	0.53	1.6	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Selenium	6010B	0.44	1.6	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Silver	6010B	0.13	0.4	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Thallium	6010B	0.27	0.8	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Titanium	6010B	1.3	4	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Zinc	6010B	0.27	0.8	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Mercury	7471A	0.007	0.02	NA	0.995	80-120	<MQL	70-130	30	50	NA	NA
Organochlorine Pesticides												
4,4'-DDD	8081A	0.0008	0.004	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
4,4'-DDE	8081A	0.0013	0.004	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
4,4'-DDT	8081A	0.0013	0.004	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Aldrin	8081A	0.0007	0.002	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
alpha-BHC	8081A	0.0007	0.002	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
alpha-Chlordane	8081A	0.0007	0.002	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
beta-BHC	8081A	0.0013	0.004	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA

TABLE A-4 - QUALITY CONTROL OBJECTIVES
MEDIA: SOIL

Analyte	Method[1]	Target MDL[2] (mg/Kg)	Target MQL[3] (mg/Kg)	Max %RSD[4]	Min r (Correl. Coeff)	CCV[5] REC.	Blank Conc. [6]	LCS MS/MSD REC.[7]	Analytical Dup RPD	Field Dup RPD	SU REC.[7]	IS Area[8]
delta-BHC	8081A	0.0007	0.002	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Dieldrin	8081A	0.0005	0.004	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Endosulfan I	8081A	0.0007	0.002	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Endosulfan II	8081A	0.0013	0.004	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Endosulfan sulfate	8081A	0.0013	0.004	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Endrin	8081A	0.0013	0.004	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Endrin aldehyde	8081A	0.0013	0.004	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Endrin ketone	8081A	0.0013	0.004	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
gamma-BHC (Lindane)	8081A	0.001	0.002	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
gamma-Chlordane	8081A	0.0013	0.004	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Heptachlor	8081A	0.0007	0.002	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Heptachlor epoxide	8081A	0.0013	0.004	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Methoxychlor	8081A	0.0067	0.02	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Toxaphene	8081A	0.0667	0.2	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Polychlorinated Biphenyls												
Aroclor-1016	8082	0.0233	0.07	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Aroclor-1221	8082	0.0233	0.07	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Aroclor-1232	8082	0.0233	0.07	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Aroclor-1242	8082	0.0233	0.07	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Aroclor-1248	8082	0.0233	0.07	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Aroclor-1254	8082	0.0233	0.07	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Aroclor-1260	8082	0.0233	0.07	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Individual Congeners	8082	0.0066	0.0066	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Volatile Organics												
1,1,1,2-Tetrachloroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,1,1-Trichloroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,1,2,2-Tetrachloroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,1,2-Trichloroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,1-Dichloroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,1-Dichloroethene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,1-Dichloropropene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,2,3-Trichloropropane	8260B	0.0007	0.002	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,2,4-Trichlorobenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%

TABLE A-4 - QUALITY CONTROL OBJECTIVES
MEDIA: SOIL

Analyte	Method[1]	Target MDL[2] (mg/Kg)	Target MQL[3] (mg/Kg)	Max %RSD[4]	Min r (Correl. Coeff)	CCV[5] REC.	Blank Conc. [6]	LCS MS/MSD REC.[7]	Analytical Dup RPD	Field Dup RPD	SU REC.[7]	IS Area[8]
1,2,4-Trimethylbenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,2-Dibromo-3-chloropropane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,2-Dibromoethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,2-Dichlorobenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,2-Dichloroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,2-Dichloroethene (Total)	8260B	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,2-Dichloropropane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,3,5-Trimethylbenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,3-Dichlorobenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,3-Dichloropropane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,4-Dichlorobenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2,2-Dichloropropane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2-Butanone	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2-Chloroethylvinyl ether	8260B	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2-Chlorotoluene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2-Hexanone	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
4-Chlorotoluene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
4-Isopropyltoluene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
4-Methyl-2-pentanone	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Acetone	8260B	0.0083	0.025	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Acrolein	8260B	0.0083	0.025	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Acrylonitrile	8260B	0.0083	0.025	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Benzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Bromobenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Bromodichloromethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Bromoform	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Bromomethane	8260B	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Butanol	8260B	0.0083	0.025	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Carbon disulfide	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Carbon tetrachloride	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Chlorobenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Chloroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Chloroform	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Chloromethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%

TABLE A-4 - QUALITY CONTROL OBJECTIVES
MEDIA: SOIL

Analyte	Method[1]	Target MDL[2] (mg/Kg)	Target MQL[3] (mg/Kg)	Max %RSD[4]	Min r (Correl. Coeff)	CCV[5] REC.	Blank Conc. [6]	LCS MS/MSD REC.[7]	Analytical Dup RPD	Field Dup RPD	SU REC.[7]	IS Area[8]
cis-1,2-Dichloroethene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
cis-1,3-Dichloropropene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Dibromochloromethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Dibromomethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Dichlorodifluoro-methane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Ethylbenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Hexachlorobutadiene	8260B	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Isopropylbenzene (Cumene)	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Methyl Acetate	8260B	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Methyl iodide	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Methylcyclohexane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Methylene chloride	8260B	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
n-Butylbenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
n-Propylbenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
o-Xylene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
sec-Butylbenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Styrene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
tert-Butyl methyl ether (MTBE)	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
tert-Butylbenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Tetrachloroethene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Toluene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
trans-1,2-Dichloroethene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
trans-1,3-Dichloropropene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
trans-1,4-Dichloro-2-butene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Trichloroethene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Trichlorofluoromethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Trichlorotrifluoroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Vinyl acetate	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Vinyl chloride	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Xylene (total)	8260B	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%

TABLE A-4 - QUALITY CONTROL OBJECTIVES
MEDIA: SOIL

Analyte	Method[1]	Target MDL[2] (mg/Kg)	Target MQL[3] (mg/Kg)	Max %RSD[4]	Min r (Correl. Coeff)	CCV[5] REC.	Blank Conc. [6]	LCS MS/MSD REC.[7]	Analytical Dup RPD	Field Dup RPD	SU REC.[7]	IS Area[8]
SEMIVOLATILE ORGANICS												
1,2Diphenylhydrazine/ Azobenzene	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2,4,5-Trichlorophenol	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2,4,6-Trichlorophenol	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2,4-Dichlorophenol	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2,4-Dimethylphenol	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2,4-Dinitrophenol	8270C	0.55	1.65	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2,4-Dinitrotoluene	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2,6-Dinitrotoluene	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2-Chloronaphthalene	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2-Chlorophenol	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2-Methylnaphthalene	8270C	0.022	0.066	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2-Nitroaniline	8270C	0.55	1.65	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2-Nitrophenol	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
3,3'-Dichlorobenzidine	8270C	0.22	0.66	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
3-Nitroaniline	8270C	0.55	1.65	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
4,6-Dinitro-2-methylphenol	8270C	0.55	1.65	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
4-Bromophenyl phenyl ether	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
4-Chloro-3-methylphenol	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
4-Chloroaniline	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
4-Chlorophenyl phenyl ether	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
4-Nitroaniline	8270C	0.55	1.65	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
4-Nitrophenol	8270C	0.55	1.65	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Acenaphthene	8270C	0.022	0.066	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Acenaphthylene	8270C	0.022	0.066	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Acetophenone	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Aniline	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Anthracene	8270C	0.022	0.066	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Atrazine (Aatrex)	8270C	0.22	0.66	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Benzaldehyde	8270C	0.22	0.66	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%

TABLE A-4 - QUALITY CONTROL OBJECTIVES
MEDIA: SOIL

Analyte	Method[1]	Target MDL[2] (mg/Kg)	Target MQL[3] (mg/Kg)	Max %RSD[4]	Min r (Correl. Coeff)	CCV[5] REC.	Blank Conc. [6]	LCS MS/MSD REC.[7]	Analytical Dup RPD	Field Dup RPD	SU REC.[7]	IS Area[8]
Benzidine	8270C	0.067	1.32	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Benzo(a)anthracene	8270C	0.022	0.066	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Benzo(a)pyrene	8270C	0.022	0.066	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Benzo(b)fluoranthene	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Benzo(g,h,i)perylene	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Benzo(k)fluoranthene	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Benzoic acid	8270C	0.55	1.65	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Benzyl alcohol	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Biphenyl	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Bis(2-Chloroethoxy)methane	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Bis(2-Chloroethyl)ether	8270C	0.105	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Bis(2-Chloroisopropyl)ether	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Bis(2-Ethylhexyl)phthalate	8270C	0.022	0.066	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Butyl benzyl phthalate	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Caprolactam	8270C	0.22	0.66	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Carbazole	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Chrysene	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Dibenz(a,h)anthracene	8270C	0.022	0.066	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Dibenzofuran	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Diethyl phthalate	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Dimethyl phthalate	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Di-n-butyl phthalate	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Di-n-octyl phthalate	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Fluoranthene	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Fluorene	8270C	0.022	0.066	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Hexachlorobenzene	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Hexachlorocyclo-pentadiene	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Hexachloroethane	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Indeno(1,2,3-cd)pyrene	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Isophorone	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Nitrobenzene	8270C	0.019	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
n-Nitrosodimethylamine	8270C	0.065	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%

TABLE A-4 - QUALITY CONTROL OBJECTIVES
MEDIA: SOIL

Analyte	Method[1]	Target MDL[2] (mg/Kg)	Target MQL[3] (mg/Kg)	Max %RSD[4]	Min r (Correl. Coeff)	CCV[5] REC.	Blank Conc. [6]	LCS MS/MSD REC.[7]	Analytical Dup RPD	Field Dup RPD	SU REC.[7]	IS Area[8]
n-Nitrosodi-n-propylamine	8270C	0.022	0.066	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
n-Nitrosodiphenylamine	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
o-Cresol	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Phenanthrene	8270C	0.022	0.066	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Phenol	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Pyrene	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Pyridine	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%

Notes:

1. Unless otherwise indicated, analytical methods are from EPA SW-846 "Test Methods for Evaluating Solid Waste."
2. Method Detection Limits are determined by the laboratory using the procedures in 40 CFR Part 136, Appendix B. The MDL listed here is the maximum method detection limit that will support the project performance objectives. Sample Detection Limits (which are adjusted to reflect sample-specific actions, such as dilution or use of smaller aliquot sizes than prescribed in the analytical method, and take into account sample characteristics, sample preparation, sample cleanup, and analytical adjustments including dry-weight adjustments) will be higher.
3. Method Quantitation Limits correspond to the lowest non-zero concentration standard in the laboratory's initial calibration curve calculated using the normal aliquot sizes and final volumes prescribed in the analytical method. The MQL listed here is based on typical laboratory performance. Sample Quantitation Limits (which are adjusted to reflect sample-specific actions, such as dilution or use of smaller aliquot sizes than prescribed in the analytical method, and take into account sample characteristics, sample preparation, sample cleanup, and analytical adjustments including dry-weight adjustments) will be higher.
4. Per the analytical methods for organics, the %RSD for an individual analyte may exceed the criteria as long as the mean %RSD for all calibrated analytes is within the criteria. For data qualification purposes, the %RSD criteria will be applied to each individual analyte and the data flagged accordingly. For GC/MS analyses, the analytical method also includes criteria for the Relative Response Factor (RRF) for a subset of the calibrated analytes. For data qualification purposes, a minimum RRF criteria of 0.05 will be applied to each individual analyte and the data flagged accordingly.
5. Per the analytical methods for organics, the CCV response for an individual analyte may be outside the criteria as long as the mean CCV response for all calibrated analytes is within the criteria. For data qualification purposes, the CCV criteria will be applied to each individual analyte and the data flagged accordingly. For inorganics, the same limits apply for the ICV.
6. Criteria apply for all blank types including method blanks, calibration blanks, equipment blanks, and trip blanks. For data qualification purposes, blank concentrations for all positively identified analytes (i.e., above the detection limit) will be assessed and the data flagged accordingly. However, laboratory corrective action is instituted only for concentrations above the quantitation limit.
7. Criteria are for data qualification purposes. The laboratory shall monitor performance and institute routine corrective action using the laboratory-established limits but the lower limit shall not be below 10% for organics and 30% for inorganics.
8. Expressed as percent of area for internal standard in midpoint calibration standard.

APPENDIX B

QA/QC INFORMATION - GROUNDWATER

TABLE B-1 - PARAMETERS AND METHOD SPECIFICATIONS

MEDIA: GROUNDWATER

Intended Use: Nature and extent of contamination
Quantitative risk assessment - human health and ecological

QC Level: 100% Level III

Laboratory Parameters	Sampling SOP	Measurement Technique	Preparation Method	Analysis Method
Chemical Analyses				
Hardness	PBW-SOP-10	By Calculation	NA	SM 2340B
Total Dissolved Solids	PBW-SOP-10	Gravimetric	NA	EPA 160.1
Total Suspended Solids	PBW-SOP-10	Gravimetric	NA	EPA 160.2
Total Organic Carbon	PBW-SOP-10	Carbonaceous Analyzer	NA	SW-846 9060
Chloride	PBW-SOP-10	Colorimetric	NA	SW-846 9251
Sulfate	PBW-SOP-10	Turbidimetric	NA	SW-846 9038
Major Anions (Ca, Mg, K, Na)	PBW-SOP-10	ICP-AES	SW846 3010A	SW846 6010B
Chromium VI	PBW-SOP-10	Colorimetric	NA	SW846 7196A
Metals	PBW-SOP-10	ICP-AES	SW846 3010A	SW846 6010B
Mercury	PBW-SOP-10	Cold Vapor AA	SW846 7470A	SW846 7470A
Organochlorine Pesticides	PBW-SOP-10	GC	SW846 3510C	SW846 8081A
PCBs	PBW-SOP-10	GC	SW846 3510C	SW846 8082
VOCs	PBW-SOP-10	GC/MS	SW846 5030B	SW846 8260B
SVOCs	PBW-SOP-10	GC/MS	SW846 3510C	SW846 8270C
NAPL Analyses				
Specific Gravity	PBW-SOP-10	gravimetric	NA	SM 2710F
Organochlorine Pesticides	PBW-SOP-10	GC	NA	SW846 8081A
VOCs	PBW-SOP-10	GC/MS	NA	SW846 8260B
SVOCs	PBW-SOP-10	GC/MS	NA	SW846 8270C

TABLE B-2 - SAMPLE CONTAINER, PRESERVATION AND HOLDING TIME REQUIREMENTS

MEDIA: GROUNDWATER

Laboratory Parameters	Container	Preservation	Holding Time
Hardness	P, G	HNO3 to pH < 2	6 months
Total Dissolved Solids	P, G	Cool to 4 C	7 days
Total Suspended SolidS	P, G	Cool to 4 C	7 days
Total Organic Carbon	P, G	HCl to pH < 2[1] Cool to 4 C	28 days
Chloride	P, G	Cool to 4 C	28 days
Sulfate	P, G	Cool to 4 C	28 days
Major Anions (Ca, Mg, K, Na)	P, G	HNO3 to pH < 2	6 months
Chromium VI	P, G	Cool to 4 C	24 hours
Metals	P, G	HNO3 to pH < 2	6 months
Mercury	P, G	HNO3 to pH < 2	28 days
Organochlorine Pesticides	G-TLC (Amber)	Cool to 4 C	7 days (preparation) 40 days (analysis)
PCBs	G-TLC (Amber)	Cool to 4 C	7 days (preparation) 40 days (analysis)
VOCs[2]	G-TLS	HCl to pH < 2[1] Cool to 4 C	14 days
SVOCs	G-TLC (Amber)	Cool to 4 C	7 days (preparation) 40 days (analysis)

P – Polyethylene G – Glass TLC – Teflon®-lined cap TLS – Teflon®-lined septum

Notes:
1. H_2SO_4 or solid $NaHSO_4$ are also acceptable preservatives.
2. Samples shall not contain headspace or air bubbles.

TABLE B-3 - FIELD QUALITY CONTROL SAMPLE REQUIREMENTS

MEDIA: GROUNDWATER

Laboratory Parameters	Trip Blanks	Equipment/ Field Blanks	Field Duplicates[1]	Matrix Spikes/ Matrix Spike Duplicates[1]
Chromium VI	NA	1 per day	1 per 20 samples	1 per 20 samples[2]
Metals	NA	1 per day	1 per 20 samples	1 per 20 samples[2]
Mercury	NA	1 per day	1 per 20 samples	1 per 20 samples[2]
Organochlorine Pesticides	NA	1 per day	1 per 20 samples	1 per 20 samples
PCBs	NA	1 per day	1 per 20 samples	1 per 20 samples
VOCs	1 per cooler	1 per day	1 per 20 samples	1 per 20 samples
SVOCs	NA	1 per day	1 per 20 samples	1 per 20 samples

Notes:
1. Frequency is one per twenty samples or one per day, whichever is greater.
2. An analytical duplicate (i.e., unspiked) may be substituted for the matrix spike duplicate.

TABLE B-4 - QUALITY CONTROL OBJECTIVES

MEDIA: GROUNDWATER

Analyte	Method[1]	Target MDL[2] (mg/L)	Target MQL[3] (mg/L)	Max %RSD[4]	Min r (Correl. Coeff)	CCV[5] REC.	Blank Conc.[6]	LCS MS/ MSD REC.[7]	Analytical Dup RPD	Field Dup RPD	SU REC.[7]	IS Area[8]
Hardness	Std Methods 2340B	0.23	0.66	NA	NA	70-130	<MQL	70-130	30	NA	NA	NA
Total Dissolved Solids (TDS)	EPA 160.1	10	10	NA	NA	NA	<MQL	NA	30	NA	NA	NA
Total Suspended Solids	EPA 160.2	1	1	NA	NA	NA	<MQL	NA	30	NA	NA	NA
Total Organic Carbon	9060	1	1	NA	NA	70-130	<MQL	70-130	30	NA	NA	NA
Chloride	9251	0.333	1	NA	NA	70-130	<MQL	70-130	30	NA	NA	NA
Sulfate	9038	1.67	5	NA	NA	70-130	<MQL	70-130	30	NA	NA	NA
Chromium (VI)	7196A	0.008	0.02	NA	NA	70-130	<MQL	70-130	30	40	NA	NA
ICP Metals												
Aluminum	6010B	0.067	0.2	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Antimony	6010B	0.006	0.06	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Arsenic	6010B	0.01	0.04	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Barium	6010B	0.003	0.01	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Beryllium	6010B	0.002	0.005	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Boron	6010B	0.333	1	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Cadmium	6010B	0.002	0.005	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Cobalt	6010B	0.003	0.01	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Copper	6010B	0.002	0.01	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Iron	6010B	0.033	0.1	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Lead	6010B	0.003	0.015	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Lithium	6010B	0.017	0.05	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Manganese	6010B	0.005	0.015	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Nickel	6010B	0.002	0.04	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Selenium	6010B	0.013	0.04	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Silver	6010B	0.002	0.01	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Thallium	6010B	0.0029	0.02	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Titanium	6010B	0.033	0.1	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Zinc	6010B	0.007	0.02	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
MERCURY	7470A	0.0002	0.0004	NA	0.995	80-120	<MQL	70-130	30	40	NA	NA
Organochlorine Pesticides												
4,4'-DDD	8081A	0.000025	0.0001	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
4,4'-DDE	8081A	0.00003	0.0001	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
4,4'-DDT	8081A	0.000018	0.0001	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Aldrin	8081A	0.00002	0.00005	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA

TABLE B-4 - QUALITY CONTROL OBJECTIVES

MEDIA: GROUNDWATER

Analyte	Method[1]	Target MDL[2] (mg/L)	Target MQL[3] (mg/L)	Max %RSD[4]	Min r (Correl. Coeff)	CCV[5] REC.	Blank Conc.[6]	LCS MS/ MSD REC.[7]	Analytical Dup RPD	Field Dup RPD	SU REC.[7]	IS Area[8]
alpha-BHC	8081A	0.00002	0.00005	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
alpha-Chlordane	8081A	0.00002	0.00005	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
beta-BHC	8081A	0.00002	0.00005	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
delta-BHC	8081A	0.00002	0.00005	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Dieldrin	8081A	0.000015	0.0001	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Endosulfan I	8081A	0.000009	0.00005	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Endosulfan II	8081A	0.000024	0.0001	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Endosulfan sulfate	8081A	0.000009	0.0001	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Endrin	8081A	0.000025	0.0001	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Endrin aldehyde	8081A	0.00003	0.0001	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Endrin ketone	8081A	0.00003	0.0001	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
gamma-BHC (Lindane)	8081A	0.000016	0.00005	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
gamma-Chlordane	8081A	0.00003	0.0001	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Heptachlor	8081A	0.000014	0.00005	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Heptachlor epoxide	8081A	0.000022	0.00005	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Methoxychlor	8081A	0.00003	0.0005	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Toxaphene	8081A	0.000825	0.005	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Polychlorinated Biphenyls												
Aroclor-1016	8082	0.00067	0.002	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Aroclor-1221	8082	0.00067	0.002	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Aroclor-1232	8082	0.00067	0.002	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Aroclor-1242	8082	0.00067	0.002	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Aroclor-1248	8082	0.00067	0.002	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Aroclor-1254	8082	0.00067	0.002	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Aroclor-1260	8082	0.00067	0.002	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Individual Congeners	8082	0.00002	0.00002	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Volatile Organics												
1,1,1,2-Tetrachloroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,1,1-Trichloroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,1,2,2-Tetrachloroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,1,2-Trichloroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,1-Dichloroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,1-Dichloroethene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,1-Dichloropropene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%

TABLE B-4 - QUALITY CONTROL OBJECTIVES

MEDIA: GROUNDWATER

Analyte	Method[1]	Target MDL[2] (mg/L)	Target MQL[3] (mg/L)	Max %RSD[4]	Min r (Correl. Coeff)	CCV[5] REC.	Blank Conc.[6]	LCS MS/ MSD REC.[7]	Analytical Dup RPD	Field Dup RPD	SU REC.[7]	IS Area[8]
1,2,3-Trichloropropane	8260B	0.0007	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,2,4-Trichlorobenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,2,4-Trimethylbenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,2-Dibromo-3-chloropropane	8260B	0.0003	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,2-Dibromoethane	8260B	0.0004	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,2-Dichlorobenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,2-Dichloroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,2-Dichloroethene (Total)	8260B	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,2-Dichloropropane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,3,5-Trimethylbenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,3-Dichlorobenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,3-Dichloropropane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,4-Dichlorobenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2,2-Dichloropropane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2-Butanone	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2-Chloroethylvinyl ether	8260B	0.0008	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2-Chlorotoluene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2-Hexanone	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
4-Chlorotoluene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
4-Isopropyltoluene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
4-Methyl-2-pentanone	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Acetone	8260B	0.0083	0.025	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Acrolein	8260B	0.0083	0.025	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Acrylonitrile	8260B	0.0017	0.025	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Benzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Bromobenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Bromodichloromethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Bromoform	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Bromomethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Butanol	8260B	0.038	0.1	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Carbon disulfide	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Carbon tetrachloride	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Chlorobenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Chloroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%

TABLE B-4 - QUALITY CONTROL OBJECTIVES

MEDIA: GROUNDWATER

Analyte	Method[1]	Target MDL[2] (mg/L)	Target MQL[3] (mg/L)	Max %RSD[4]	Min r (Correl. Coeff)	CCV[5] REC.	Blank Conc.[6]	LCS MS/ MSD REC.[7]	Analytical Dup RPD	Field Dup RPD	SU REC.[7]	IS Area[8]
Chloroform	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Chloromethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
cis-1,2-Dichloroethene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
cis-1,3-Dichloropropene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Dibromochloromethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Dibromomethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Dichlorodifluoro methane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Ethylbenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Hexachlorobutadiene	8260B	0.0004	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Isopropylbenzene (Cumene)	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Methyl Acetate	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Methyl iodide	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Methylcyclohexane	8260B	0.008	0.02	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Methylene chloride	8260B	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
n-Butylbenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
n-Propylbenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
o-Xylene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
sec-Butylbenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Styrene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
tert-Butyl methyl ether (MTBE)	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
tert-Butylbenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Tetrachloroethene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Toluene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
trans-1,2-Dichloroethene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
trans-1,3-Dichloropropene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
trans-1,4-Dichloro-2-butene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Trichloroethene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Trichlorofluoromethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Trichlorotrifluoroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Vinyl acetate	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Vinyl chloride	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%

TABLE B-4 - QUALITY CONTROL OBJECTIVES

MEDIA: GROUNDWATER

Analyte	Method[1]	Target MDL[2] (mg/L)	Target MQL[3] (mg/L)	Max %RSD[4]	Min r (Correl. Coeff)	CCV[5] REC.	Blank Conc.[6]	LCS MS/ MSD REC.[7]	Analytical Dup RPD	Field Dup RPD	SU REC.[7]	IS Area[8]
Xylene (total)	8260B	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Semivolatile Organics												
1,2Diphenylhydrazine/ Azobenzene	8270C	0.0011	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2,4,5-Trichlorophenol	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2,4,6-Trichlorophenol	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2,4-Dichlorophenol	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2,4-Dimethylphenol	8270C	0.01	0.02	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2,4-Dinitrophenol	8270C	0.0167	0.05	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2,4-Dinitrotoluene	8270C	0.0013	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2,6-Dinitrotoluene	8270C	0.0013	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2-Chloronaphthalene	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2-Chlorophenol	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2-Methylnaphthalene	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2-Nitroaniline	8270C	0.0073	0.05	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2-Nitrophenol	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
3,3'-Dichlorobenzidine	8270C	0.002	0.02	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
3-Nitroaniline	8270C	0.0073	0.05	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
4,6-Dinitro-2-methylphenol	8270C	0.0167	0.05	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
4-Bromophenyl phenyl ether	8270C	0.0006	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
4-Chloro-3-methylphenol	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
4-Chloroaniline	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
4-Chlorophenyl phenyl ether	8270C	0.0006	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
4-Nitroaniline	8270C	0.0167	0.05	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
4-Nitrophenol	8270C	0.0167	0.05	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Acenaphthene	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Acenaphthylene	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Acetophenone	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Aniline	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Anthracene	8270C	0.0006	0.002	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Atrazine (Aatrex)	8270C	0.003	0.02	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Benzaldehyde	8270C	0.0067	0.02	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Benzidine	8270C	0.0108	0.04	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%

TABLE B-4 - QUALITY CONTROL OBJECTIVES

MEDIA: GROUNDWATER

Analyte	Method[1]	Target MDL[2] (mg/L)	Target MQL[3] (mg/L)	Max %RSD[4]	Min r (Correl. Coeff)	CCV[5] REC.	Blank Conc.[6]	LCS MS/ MSD REC.[7]	Analytical Dup RPD	Field Dup RPD	SU REC.[7]	IS Area[8]
Benzo(a)anthracene	8270C	0.0013	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Benzo(a)pyrene	8270C	0.0002	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Benzo(b)fluoranthene	8270C	0.0013	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Benzo(g,h,i)perylene	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Benzo(k)fluoranthene	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Benzoic acid	8270C	0.0167	0.05	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Benzyl alcohol	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Biphenyl	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Bis(2-Chloroethoxy)methane	8270C	0.0008	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Bis(2-Chloroethyl)ether	8270C	0.0008	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Bis(2-Chloroisopropyl)ether	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Bis(2-Ethylhexyl)phthalate	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Butyl benzyl phthalate	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Caprolactam	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Carbazole	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Chrysene	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Dibenz(a,h)anthracene	8270C	0.0005	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Dibenzofuran	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Diethyl phthalate	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Dimethyl phthalate	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Di-n-butyl phthalate	8270C	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Di-n-octyl phthalate	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Fluoranthene	8270C	0.0007	0.002	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Fluorene	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Hexachlorobenzene	8270C	0.001	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Hexachlorocyclo-pentadiene	8270C	0.0028	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Hexachloroethane	8270C	0.0022	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Indeno(1,2,3-cd)pyrene	8270C	0.0013	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Isophorone	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Nitrobenzene	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
n-Nitrosodimethylamine	8270C	0.0018	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
n-Nitrosodi-n-propylamine	8270C	0.0004	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%

TABLE B-4 - QUALITY CONTROL OBJECTIVES

MEDIA: GROUNDWATER

Analyte	Method[1]	Target MDL[2] (mg/L)	Target MQL[3] (mg/L)	Max %RSD[4]	Min r (Correl. Coeff)	CCV[5] REC.	Blank Conc.[6]	LCS MS/ MSD REC.[7]	Analytical Dup RPD	Field Dup RPD	SU REC.[7]	IS Area[8]
n-Nitrosodiphenylamine	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
o-Cresol	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Phenanthrene	8270C	0.0007	0.002	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Phenol	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Pyrene	8270C	0.0004	0.002	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Pyridine	8270C	0.0067	0.02	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%

Notes:

1. Unless otherwise indicated, analytical methods are from EPA SW-846 “Test Methods for Evaluating Solid Waste.”
2. Method Detection Limits are determined by the laboratory using the procedures in 40 CFR Part 136, Appendix B. The MDL listed here is the maximum method detection limit that will support the project performance objectives. Sample Detection Limits (which are adjusted to reflect sample-specific actions, such as dilution or use of smaller aliquot sizes than prescribed in the analytical method, and take into account sample characteristics, sample preparation, sample cleanup, and analytical adjustments including dry-weight adjustments) will be higher.
3. Method Quantitation Limits correspond to the lowest non-zero concentration standard in the laboratory’s initial calibration curve calculated using the normal aliquot sizes and final volumes prescribed in the analytical method. The MQL listed here is based on typical laboratory performance. Sample Quantitation Limits (which are adjusted to reflect sample-specific actions, such as dilution or use of smaller aliquot sizes than prescribed in the analytical method, and take into account sample characteristics, sample preparation, sample cleanup, and analytical adjustments including dry-weight adjustments) will be higher.
4. Per the analytical methods for organics, the %RSD for an individual analyte may exceed the criteria as long as the mean %RSD for all calibrated analytes is within the criteria. For data qualification purposes, the %RSD criteria will be applied to each individual analyte and the data flagged accordingly. For GC/MS analyses, the analytical method also includes criteria for the Relative Response Factor (RRF) for a subset of the calibrated analytes. For data qualification purposes, a minimum RRF criteria of 0.05 will be applied to each individual analyte and the data flagged accordingly.
5. Per the analytical methods for organics, the CCV response for an individual analyte may be outside the criteria as long as the mean CCV response for all calibrated analytes is within the criteria. For data qualification purposes, the CCV criteria will be applied to each individual analyte and the data flagged accordingly. For inorganics, the same limits apply for the ICV.
6. Criteria apply for all blank types including method blanks, calibration blanks, equipment blanks, and trip blanks. For data qualification purposes, blank concentrations for all positively identified analytes (i.e., above the detection limit) will be assessed and the data flagged accordingly. However, laboratory corrective action is instituted only for concentrations above the quantitation limit.
7. Criteria are for data qualification purposes. The laboratory shall monitor performance and institute routine corrective action using the laboratory-established limits but the lower limit shall not be below 10% for organics and 30% for inorganics.
8. Expressed as percent of area for internal standard in midpoint calibration standard.

APPENDIX C

QA/QC INFORMATION – SURFACE WATER

TABLE C-1 - PARAMETERS AND METHOD SPECIFICATIONS

MEDIA: SURFACE WATER

Intended Use: Quantitative risk assessment - human health and ecological

QC Level: Level III with Level IV for 10% of the sample sets (selected by RI Manager with consideration given to sample results, location and matrix)

Laboratory Parameters	Sampling SOP	Measurement Technique	Preparation Method	Analysis Method
Chemical Analyses				
Hardness	PBW-SOP-10 BESI-SOP-600	By Calculation	NA	SM 2340B
Total Dissolved Solids	PBW-SOP-10 BESI-SOP-600	Gravimetric	NA	EPA 160.1
Total Suspended Solids	PBW-SOP-10 BESI-SOP-600	Gravimetric	NA	EPA 160.2
Total Organic Carbon	PBW-SOP-10 BESI-SOP-600	Carbonaceous Analyzer	NA	SW-846 9060
Chloride	PBW-SOP-10 BESI-SOP-600	Colorimetric	NA	SW-846 9251
Sulfate	PBW-SOP-10 BESI-SOP-600	Turbidimetric	NA	SW-846 9038
Major Anions (Ca, Mg, K, Na)	PBW-SOP-10 BESI-SOP-600	ICP-AES	SW846 3010A	SW846 6010B
Chromium VI	PBW-SOP-10 BESI-SOP-600	Colorimetric	NA	SW846 7196A
Metals (total)	PBW-SOP-10 BESI-SOP-600	ICP-AES	SW846 3010A	SW846 6010B
Metals (dissolved)	PBW-SOP-10 BESI-SOP-600	ICP-AES	SW846 3010A	SW846 6010B
Mercury	PBW-SOP-10 BESI-SOP-600	Cold Vapor AA	SW846 7470A	SW846 7470A
Organochlorine Pesticides	PBW-SOP-10 BESI-SOP-600	GC	SW846 3510C	SW846 8081A
PCBs	PBW-SOP-10 BESI-SOP-600	GC	SW846 3510C	SW846 8082
VOCs	PBW-SOP-10 BESI-SOP-600	GC/MS	SW846 5030B	SW846 8260B
SVOCs	PBW-SOP-10 BESI-SOP-600	GC/MS	SW846 3510C	SW846 8270C

TABLE C-2 - SAMPLE CONTAINER, PRESERVATION AND HOLDING TIME REQUIREMENTS

MEDIA: SURFACE WATER

Laboratory Parameters	Container	Preservation	Holding Time
Hardness	P, G	HNO3 to pH < 2	6 months
Total Dissolved Solids	P, G	Cool to 4 C	7 days
Total Suspended Solids	P, G	Cool to 4 C	7 days
Total Organic Carbon	P, G	HCl to pH < 2(1) Cool to 4 C	28 days
Chloride	P, G	Cool to 4 C	28 days
Sulfate	P, G	Cool to 4 C	28 days
Major Anions (Ca, Mg, K, Na)	P, G	HNO3 to pH < 2	6 months
Chromium VI	P, G	Cool to 4 C	24 hours
Metals (total)	P, G	HNO3 to pH < 2	6 months
Metals (dissolved)	P, G	Filter onsite HNO3 to pH < 2	6 months
Mercury	P, G	HNO3 to pH < 2	28 days
Organochlorine Pesticides	G-TLC (Amber)	Cool to 4 C	7 days (preparation) 40 days (analysis)
PCBs	G-TLC (Amber)	Cool to 4 C	7 days (preparation) 40 days (analysis)
VOCs(2)	G-TLS	HCl to pH < 2(1) Cool to 4 C	14 days
SVOCs	G-TLC (Amber)	Cool to 4 C	7 days (preparation) 40 days (analysis)

P – Polyethylene G – Glass TLC – Teflon®-lined cap TLS – Teflon®-lined septum

Notes:
1. H_2SO_4 or solid $NaHSO_4$ are also acceptable preservatives.
2. Samples shall not contain headspace or air bubbles.

TABLE C-3 - FIELD QUALITY CONTROL SAMPLE REQUIREMENTS

MEDIA: SURFACE WATER

Laboratory Parameters	Trip Blanks	Equipment/ Field Blanks	Field Duplicates[(1)]	Matrix Spikes/ Matrix Spike Duplicates[(1)]
Chromium VI	NA	1 per day	1 per 20 samples	1 per 20 samples[(2)]
Metals (total)	NA	1 per day	1 per 20 samples	1 per 20 samples[(2)]
Metals (dissolved)	NA	1 per day	1 per 20 samples	1 per 20 samples[(2)]
Mercury	NA	1 per day	1 per 20 samples	1 per 20 samples[(2)]
Organochlorine Pesticides	NA	1 per day	1 per 20 samples	1 per 20 samples
PCBs	NA	1 per day	1 per 20 samples	1 per 20 samples
VOCs	1 per cooler	1 per day	1 per 20 samples	1 per 20 samples
SVOCs	NA	1 per day	1 per 20 samples	1 per 20 samples

Notes:
1. Frequency is one per twenty samples or one per day, whichever is greater.
2. An analytical duplicate (i.e., unspiked) may be substituted for the matrix spike duplicate.

TABLE C-4 - QUALITY CONTROL OBJECTIVES

MEDIA: SURFACE WATER

Analyte	Method[1]	Target MDL[2] (mg/L)	Target MQL[3] (mg/L)	Max %RSD[4]	Min r (Correl. Coeff)	CCV[5] REC.	Blank Conc.[6]	LCS MS/ MSD REC.[7]	Analytical Dup RPD	Field Dup RPD	SU REC.[7]	IS Area[8]
Hardness	Std Methods 2340B	0.23	0.66	NA	NA	70-130	<MQL	70-130	30	NA	NA	NA
Total Dissolved Solids (TDS)	EPA 160.1	10	10	NA	NA	NA	<MQL	NA	30	NA	NA	NA
Total Suspended Solids	EPA 160.2	1	1	NA	NA	NA	<MQL	NA	30	NA	NA	NA
Total Organic Carbon	9060	1	1	NA	NA	70-130	<MQL	70-130	30	NA	NA	NA
Chloride	9251	0.333	1	NA	NA	70-130	<MQL	70-130	30	NA	NA	NA
Sulfate	9038	1.67	5	NA	NA	70-130	<MQL	70-130	30	NA	NA	NA
Chromium (VI)	7196A	0.008	0.02	NA	NA	70-130	<MQL	70-130	30	40	NA	NA
ICP Metals												
Aluminum	6010B	0.067	0.2	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Antimony	6010B	0.02	0.06	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Arsenic	6010B	0.013	0.04	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Barium	6010B	0.003	0.01	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Beryllium	6010B	0.002	0.005	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Boron	6010B	0.333	1	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Cadmium	6010B	0.002	0.005	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Cobalt	6010B	0.003	0.01	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Copper	6010B	0.002	0.01	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Iron	6010B	0.033	0.1	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Lead	6010B	0.003	0.015	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Lithium	6010B	0.017	0.05	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Manganese	6010B	0.005	0.015	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Nickel	6010B	0.002	0.04	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Selenium	6010B	0.013	0.04	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Silver	6010B	0.002	0.01	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Thallium	6010B	0.003	0.02	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Titanium	6010B	0.033	0.1	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Zinc	6010B	0.007	0.02	NA	0.995	90-110	<MQL	70-130	30	40	NA	NA
Mercury	7470A	0.0002	0.0004	NA	0.995	80-120	<MQL	70-130	30	40	NA	NA
Organochlorine Pesticides												
4,4'-DDD	8081A	0.000007	0.0001	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
4,4'-DDE	8081A	0.000017	0.0001	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
4,4'-DDT	8081A	0.000018	0.0001	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA

TABLE C-4 - QUALITY CONTROL OBJECTIVES

MEDIA: SURFACE WATER

Analyte	Method[1]	Target MDL[2] (mg/L)	Target MQL[3] (mg/L)	Max %RSD[4]	Min r (Correl. Coeff)	CCV[5] REC.	Blank Conc. [6]	LCS MS/ MSD REC.[7]	Analytical Dup RPD	Field Dup RPD	SU REC.[7]	IS Area[8]
Aldrin	8081A	0.00002	0.00005	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
alpha-BHC	8081A	0.000007	0.00005	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
alpha-Chlordane	8081A	0.00002	0.00005	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
beta-BHC	8081A	0.00002	0.00005	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
delta-BHC	8081A	0.00002	0.00005	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Dieldrin	8081A	0.000015	0.0001	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Endosulfan I	8081A	0.000009	0.00005	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Endosulfan II	8081A	0.000024	0.0001	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Endosulfan sulfate	8081A	0.000009	0.0001	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Endrin	8081A	0.000025	0.0001	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Endrin aldehyde	8081A	0.00003	0.0001	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Endrin ketone	8081A	0.00003	0.0001	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
gamma-BHC (Lindane)	8081A	0.000016	0.00005	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
gamma-Chlordane	8081A	0.00003	0.0001	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Heptachlor	8081A	0.000014	0.00005	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Heptachlor epoxide	8081A	0.000022	0.00005	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Methoxychlor	8081A	0.00003	0.0005	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Toxaphene	8081A	0.000825	0.005	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Polychlorinated Biphenyls												
Aroclor-1016	8082	0.00067	0.002	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Aroclor-1221	8082	0.00067	0.002	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Aroclor-1232	8082	0.00067	0.002	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Aroclor-1242	8082	0.00067	0.002	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Aroclor-1248	8082	0.00067	0.002	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Aroclor-1254	8082	0.00067	0.002	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Aroclor-1260	8082	0.00067	0.002	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Individual Congeners	8082	0.00002	0.00002	20	0.99	+/-15	<MQL	60-140	40	40	60-140	NA
Volatile Organics												
1,1,1,2-Tetrachloroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,1,1-Trichloroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,1,2,2-Tetrachloroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,1,2-Trichloroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,1-Dichloroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%

TABLE C-4 - QUALITY CONTROL OBJECTIVES

MEDIA: SURFACE WATER

Analyte	Method[1]	Target MDL[2] (mg/L)	Target MQL[3] (mg/L)	Max %RSD[4]	Min r (Correl. Coeff)	CCV[5] REC.	Blank Conc. [6]	LCS MS/ MSD REC.[7]	Analytical Dup RPD	Field Dup RPD	SU REC.[7]	IS Area[8]
1,1-Dichloroethene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,1-Dichloropropene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,2,3-Trichloropropane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,2,4-Trichlorobenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,2,4-Trimethylbenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,2-Dibromo-3-chloropropane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,2-Dibromoethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,2-Dichlorobenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,2-Dichloroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,2-Dichloroethene (Total)	8260B	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,2-Dichloropropane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,3,5-Trimethylbenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,3-Dichlorobenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,3-Dichloropropane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
1,4-Dichlorobenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2,2-Dichloropropane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2-Butanone	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2-Chloroethylvinyl ether	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2-Chlorotoluene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2-Hexanone	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
4-Chlorotoluene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
4-Isopropyltoluene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
4-Methyl-2-pentanone	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Acetone	8260B	0.0083	0.025	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Acrolein	8260B	0.0083	0.025	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Acrylonitrile	8260B	0.0073	0.025	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Benzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Bromobenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Bromodichloromethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Bromoform	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Bromomethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Butanol	8260B	0.038	0.1	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Carbon disulfide	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Carbon tetrachloride	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%

TABLE C-4 - QUALITY CONTROL OBJECTIVES

MEDIA: SURFACE WATER

Analyte	Method[1]	Target MDL[2] (mg/L)	Target MQL[3] (mg/L)	Max %RSD[4]	Min r (Correl. Coeff)	CCV[5] REC.	Blank Conc. [6]	LCS MS/ MSD REC.[7]	Analytical Dup RPD	Field Dup RPD	SU REC.[7]	IS Area[8]
Chlorobenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Chloroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Chloroform	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Chloromethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
cis-1,2-Dichloroethene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
cis-1,3-Dichloropropene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Cyclohexane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Dibromochloromethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Dibromomethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Dichlorodifluoro-methane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Ethylbenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Hexachlorobutadiene	8260B	0.0004	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Isopropylbenzene (Cumene)	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Methyl Acetate	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Methyl iodide	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Methylcyclohexane	8260B	0.008	0.02	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Methylene chloride	8260B	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
n-Butylbenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
n-Propylbenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
o-Xylene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
sec-Butylbenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Styrene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
tert-Butyl methyl ether (MTBE)	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
tert-Butylbenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Tetrachloroethene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Toluene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
trans-1,2-Dichloroethene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
trans-1,3-Dichloropropene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
trans-1,4-Dichloro-2-butene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Trichloroethene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%

TABLE C-4 - QUALITY CONTROL OBJECTIVES

MEDIA: SURFACE WATER

Analyte	Method[1]	Target MDL[2] (mg/L)	Target MQL[3] (mg/L)	Max %RSD[4]	Min r (Correl. Coeff)	CCV[5] REC.	Blank Conc. [6]	LCS MS/ MSD REC.[7]	Analytical Dup RPD	Field Dup RPD	SU REC.[7]	IS Area[8]
Trichlorofluoromethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Trichlorotrifluoroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Vinyl acetate	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Vinyl chloride	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Xylene (total)	8260B	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Semivolatile Organics												
1,2Diphenylhydrazine/ Azobenzene	8270C	0.002	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2,4,5-Trichlorophenol	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2,4,6-Trichlorophenol	8270C	0.0024	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2,4-Dichlorophenol	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2,4-Dimethylphenol	8270C	0.01	0.02	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2,4-Dinitrophenol	8270C	0.0167	0.05	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2,4-Dinitrotoluene	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2,6-Dinitrotoluene	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2-Chloronaphthalene	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2-Chlorophenol	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2-Methylnaphthalene	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2-Nitroaniline	8270C	0.0167	0.05	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
2-Nitrophenol	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
3,3'-Dichlorobenzidine	8270C	0.0005	0.02	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
3-Nitroaniline	8270C	0.0167	0.05	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
4,6-Dinitro-2-methylphenol	8270C	0.0167	0.05	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
4-Bromophenyl phenyl ether	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
4-Chloro-3-methylphenol	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
4-Chloroaniline	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
4-Chlorophenyl phenyl ether	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
4-Nitroaniline	8270C	0.0167	0.05	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
4-Nitrophenol	8270C	0.0167	0.05	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Acenaphthene	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Acenaphthylene	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Acetophenone	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%

TABLE C-4 - QUALITY CONTROL OBJECTIVES

MEDIA: SURFACE WATER

Analyte	Method[1]	Target MDL[2] (mg/L)	Target MQL[3] (mg/L)	Max %RSD[4]	Min r (Correl. Coeff)	CCV[5] REC.	Blank Conc. [6]	LCS MS/ MSD REC.[7]	Analytical Dup RPD	Field Dup RPD	SU REC.[7]	IS Area[8]
Aniline	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Anthracene	8270C	0.0006	0.002	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Atrazine (Aatrex)	8270C	0.0067	0.02	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Benzaldehyde	8270C	0.0067	0.02	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Benzidine	8270C	0.0133	0.04	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Benzo(a)anthracene	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Benzo(a)pyrene	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Benzo(b)fluoranthene	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Benzo(g,h,i)perylene	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Benzo(k)fluoranthene	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Benzoic acid	8270C	0.0167	0.05	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Benzyl alcohol	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Biphenyl	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Bis(2-Chloroethoxy)methane	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Bis(2-Chloroethyl)ether	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Bis(2-Chloroisopropyl)ether	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Bis(2-Ethylhexyl)phthalate	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Butyl benzyl phthalate	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Caprolactam	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Carbazole	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Chrysene	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Dibenz(a,h)anthracene	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Dibenzofuran	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Diethyl phthalate	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Dimethyl phthalate	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Di-n-butyl phthalate	8270C	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Di-n-octyl phthalate	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Fluoranthene	8270C	0.0007	0.002	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Fluorene	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Hexachlorobenzene	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Hexachlorocyclo-pentadiene	8270C	0.0028	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Hexachloroethane	8270C	0.0022	0.005	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%

TABLE C-4 - QUALITY CONTROL OBJECTIVES

MEDIA: SURFACE WATER

Analyte	Method[1]	Target MDL[2] (mg/L)	Target MQL[3] (mg/L)	Max %RSD[4]	Min r (Correl. Coeff)	CCV[5] REC.	Blank Conc.[6]	LCS MS/ MSD REC.[7]	Analytical Dup RPD	Field Dup RPD	SU REC.[7]	IS Area[8]
Indeno(1,2,3-cd)pyrene	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Isophorone	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Nitrobenzene	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
n-Nitrosodimethylamine	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
n-Nitrosodi-n-propylamine	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
n-Nitrosodiphenylamine	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
o-Cresol	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Phenanthrene	8270C	0.0007	0.002	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Phenol	8270C	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Pyrene	8270C	0.0004	0.002	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%
Pyridine	8270C	0.0067	0.02	15	0.99	+/-20	<MQL	60-140	40	40	60-140	-50 to +100%

Notes:

1. Unless otherwise indicated, analytical methods are from EPA SW-846 "Test Methods for Evaluating Solid Waste."
2. Method Detection Limits are determined by the laboratory using the procedures in 40 CFR Part 136, Appendix B. The MDL listed here is the maximum method detection limit that will support the project performance objectives. Sample Detection Limits (which are adjusted to reflect sample-specific actions, such as dilution or use of smaller aliquot sizes than prescribed in the analytical method, and take into account sample characteristics, sample preparation, sample cleanup, and analytical adjustments including dry-weight adjustments) will be higher.
3. Method Quantitation Limits correspond to the lowest non-zero concentration standard in the laboratory's initial calibration curve calculated using the normal aliquot sizes and final volumes prescribed in the analytical method. The MQL listed here is based on typical laboratory performance. Sample Quantitation Limits (which are adjusted to reflect sample-specific actions, such as dilution or use of smaller aliquot sizes than prescribed in the analytical method, and take into account sample characteristics, sample preparation, sample cleanup, and analytical adjustments including dry-weight adjustments) will be higher.
4. Per the analytical methods for organics, the %RSD for an individual analyte may exceed the criteria as long as the mean %RSD for all calibrated analytes is within the criteria. For data qualification purposes, the %RSD criteria will be applied to each individual analyte and the data flagged accordingly. For GC/MS analyses, the analytical method also includes criteria for the Relative Response Factor (RRF) for a subset of the calibrated analytes. For data qualification purposes, a minimum RRF criteria of 0.05 will be applied to each individual analyte and the data flagged accordingly.
5. Per the analytical methods for organics, the CCV response for an individual analyte may be outside the criteria as long as the mean CCV response for all calibrated analytes is within the criteria. For data qualification purposes, the CCV criteria will be applied to each individual analyte and the data flagged accordingly. For inorganics, the same limits apply for the ICV.
6. Criteria apply for all blank types including method blanks, calibration blanks, equipment blanks, and trip blanks. For data qualification purposes, blank concentrations for all positively identified analytes (i.e., above the detection limit) will be assessed and the data flagged accordingly. However, laboratory corrective action is instituted only for concentrations above the quantitation limit.
7. Criteria are for data qualification purposes. The laboratory shall monitor performance and institute routine corrective action using the laboratory-established limits but the lower limit shall not be below 10% for organics and 30% for inorganics.
8. Expressed as percent of area for internal standard in midpoint calibration standard.

APPENDIX D

QA/QC INFORMATION - SEDIMENT

TABLE D-1 - PARAMETERS AND METHOD SPECIFICATIONS

MEDIA: SEDIMENT

Intended Use: Investigate possibility of additional Potential Source Areas
Nature and extent of contamination
Quantitative risk assessment - human health and ecological

QC Level: Level III with Level IV for 10% of the sample sets (selected by RI Manager with consideration given to sample results, location and matrix)

Laboratory Parameters	Sampling SOP	Measurement Technique	Preparation Method	Analysis Method
Chemical Analyses				
Total Moisture	BESI-SOP-101; BESI-SOP-102	Gravimetric	NA	SM 2540G
Chloride	BESI-SOP-101; BESI-SOP-102	Colorimetric	NA	SW846 9251
Sulfate	BESI-SOP-101; BESI-SOP-102	Turbidimetric	NA	SW846 9038
Chromium VI	BESI-SOP-101; BESI-SOP-102	Colorimetric	SW846 3060A	SW846 7196A
Metals	BESI-SOP-101; BESI-SOP-102	ICP-AES	SW846 3050B	SW846 6010B
Mercury	BESI-SOP-101; BESI-SOP-102	Cold Vapor AA	SW846 7471A	SW846 7471A
Organochlorine Pesticides	BESI-SOP-101; BESI-SOP-102	GC	SW846 3550B cleanup (e.g., 3620B) as needed	SW846 8081A
PCBs	BESI-SOP-101; BESI-SOP-102	GC	SW846 3550B cleanup (e.g., 3665A) as needed	SW846 8082
VOCs	BESI-SOP-101; BESI-SOP-102	GC/MS	SW846 5035	SW846 8260B
SVOCs	BESI-SOP-101; BESI-SOP-102	GC/MS	SW846 3550B cleanup (e.g., 3640A) as needed	SW846 8270C
Grain-Size	BESI-SOP-101; BESI-SOP-102	NA	NA	ASTM C-136
Total Organic Carbon	BESI-SOP-101; BESI-SOP-102	NA	NA	SW846 415.1/9060

TABLE D-2 - SAMPLE CONTAINER, PRESERVATION AND HOLDING TIME REQUIREMENTS

MEDIA: SEDIMENT

Laboratory Parameters	Container	Preservation	Holding Time
Chemical Analyses			
Chloride	P, G	Cool to 4 C	28 days
Sulfate	P, G	Cool to 4 C	28 days
Chromium VI	P, G	Cool to 4 C	30 days (preparation) 4 days (analysis)
Metals	P, G	Cool to 4 C	6 months
Mercury	P, G	Cool to 4 C	28 days
Organochlorine Pesticides	G-TLC	Cool to 4 C	14 days (preparation) 40 days (analysis)
PCBs	G-TLC	Cool to 4 C	14 days (preparation) 40 days (analysis)
VOCs[(1)]	G-TLS or G-TLC	Cool to 4 C	14 days
SVOCs	G-TLC	Cool to 4 C	14 days (preparation) 40 days (analysis)
Grain-Size	P, G	none	none
Total Organic Carbon	P, G	Cool to 4 C	28 days

P – Polyethylene G – Glass TLC – Teflon®-lined cap TLS – Teflon®-lined septum

TABLE D-3 - FIELD QUALITY CONTROL SAMPLE REQUIREMENTS

MEDIA: SEDIMENT

Laboratory Parameters	Trip Blanks	Equipment/ Field Blanks	Field Duplicates[(1)]	Matrix Spikes/ Matrix Spike Duplicates[(1)]
Chromium VI	NA	1 per day	1 per 20 samples	1 per 20 samples[(2)]
Metals	NA	1 per day	1 per 20 samples	1 per 20 samples[(2)]
Mercury	NA	1 per day	1 per 20 samples	1 per 20 samples[(2)]
Organochlorine Pesticides	NA	1 per day	1 per 20 samples	1 per 20 samples
PCBs	NA	1 per day	1 per 20 samples	1 per 20 samples
VOCs	1 per cooler	1 per day	1 per 20 samples	1 per 20 samples
SVOCs	NA	1 per day	1 per 20 samples	1 per 20 samples

Notes:
1. Frequency is one per twenty samples or one per day, whichever is greater.
2. An analytical duplicate (i.e., unspiked) may be substituted for the matrix spike duplicate.

TABLE D-4 - QUALITY CONTROL OBJECTIVES

MEDIA: SEDIMENT

Analyte	Method[1]	Target MDL[2] (mg/L)	Target MQL[3] (mg/L)	Max %RSD[4]	Min r (Correl. Coeff)	CCV[5] REC.	Blank Conc. [6]	LCS MS/ MSD REC.[7]	Analytical Dup RPD	Field Dup RPD	SU REC.[7]	IS Area[8]
Total Moisture	Std Methods 2540 G	0.01	0.01	NA	NA	NA	NA	NA	30	NA	NA	NA
Chloride	9251	3.3	10	NA	NA	70-130	<MQL	70-130	30	NA	NA	NA
Sulfate	9038	17	50	NA	NA	70-130	<MQL	70-130	30	NA	NA	NA
Chromium (VI)	7196A	0.67	2	NA	NA	70-130	<MQL	70-130	30	50	NA	NA
ICP Metals												
Aluminum	6010B	2.7	8	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Antimony	6010B	0.67	2.4	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Arsenic	6010B	0.53	1.6	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Barium	6010B	0.13	0.4	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Beryllium	6010B	0.07	0.2	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Boron	6010B	1.1	4	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Cadmium	6010B	0.07	0.2	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Cobalt	6010B	0.13	0.4	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Copper	6010B	0.13	0.4	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Iron	6010B	1.3	4	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Lead	6010B	0.2	0.6	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Lithium	6010B	0.67	2	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Manganese	6010B	0.2	0.6	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Nickel	6010B	0.53	1.6	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Selenium	6010B	0.44	1.6	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Silver	6010B	0.13	0.4	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Thallium	6010B	0.27	0.8	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Titanium	6010B	1.3	4	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
Zinc	6010B	0.27	0.8	NA	0.995	90-110	<MQL	70-130	30	50	NA	NA
MERCURY	7471A	0.007	0.02	NA	0.995	80-120	<MQL	70-130	30	50	NA	NA
Organochlorine Pesticides												
4,4'-DDD	8081A	0.0012	0.004	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
4,4'-DDE	8081A	0.0013	0.004	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
4,4'-DDT	8081A	0.0011	0.004	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Aldrin	8081A	0.0007	0.002	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
alpha-BHC	8081A	0.0007	0.002	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
alpha-Chlordane	8081A	0.0007	0.002	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
beta-BHC	8081A	0.0013	0.004	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
delta-BHC	8081A	0.0007	0.002	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA

TABLE D-4 - QUALITY CONTROL OBJECTIVES

MEDIA: SEDIMENT

Analyte	Method[1]	Target MDL[2] (mg/L)	Target MQL[3] (mg/L)	Max %RSD[4]	Min r (Correl. Coeff)	CCV[5] REC.	Blank Conc. [6]	LCS MS/ MSD REC.[7]	Analytical Dup RPD	Field Dup RPD	SU REC.[7]	IS Area[8]
Dieldrin	8081A	0.0007	0.004	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Endosulfan I	8081A	0.0007	0.002	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Endosulfan II	8081A	0.0013	0.004	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Endosulfan sulfate	8081A	0.0013	0.004	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Endrin	8081A	0.0013	0.004	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Endrin aldehyde	8081A	0.0013	0.004	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Endrin ketone	8081A	0.0013	0.004	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
gamma-BHC (Lindane)	8081A	0.0005	0.002	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
gamma-Chlordane	8081A	0.0013	0.004	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Heptachlor	8081A	0.0007	0.002	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Heptachlor epoxide	8081A	0.0013	0.004	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Methoxychlor	8081A	0.0067	0.02	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Toxaphene	8081A	0.028	0.2	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Polychlorinated Biphenyls												
Aroclor-1016	8082	0.0227	0.07	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Aroclor-1221	8082	0.0227	0.07	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Aroclor-1232	8082	0.0227	0.07	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Aroclor-1242	8082	0.0227	0.07	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Aroclor-1248	8082	0.0227	0.07	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Aroclor-1254	8082	0.0227	0.07	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Aroclor-1260	8082	0.0227	0.07	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Individual Congeners	8082	0.0066	0.0066	20	0.99	+/-15	<MQL	60-140	40	50	60-140	NA
Volatile Organics												
1,1,1,2-Tetrachloroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,1,1-Trichloroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,1,2,2-Tetrachloroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,1,2-Trichloroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,1-Dichloroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,1-Dichloroethene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,1-Dichloropropene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,2,3-Trichloropropane	8260B	0.0007	0.002	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,2,4-Trichlorobenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,2,4-Trimethylbenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,2-Dibromo-3-	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%

TABLE D-4 - QUALITY CONTROL OBJECTIVES

MEDIA: SEDIMENT

Analyte	Method[1]	Target MDL[2] (mg/L)	Target MQL[3] (mg/L)	Max %RSD[4]	Min r (Correl. Coeff)	CCV[5] REC.	Blank Conc.[6]	LCS MS/ MSD REC.[7]	Analytical Dup RPD	Field Dup RPD	SU REC.[7]	IS Area[8]
chloropropane												
1,2-Dibromoethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,2-Dichlorobenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,2-Dichloroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,2-Dichloroethene (Total)	8260B	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,2-Dichloropropane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,3,5-Trimethylbenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,3-Dichlorobenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,3-Dichloropropane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
1,4-Dichlorobenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2,2-Dichloropropane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2-Butanone	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2-Chloroethylvinyl ether	8260B	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2-Chlorotoluene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2-Hexanone	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
4-Chlorotoluene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
4-Isopropyltoluene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
4-Methyl-2-pentanone	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Acetone	8260B	0.0083	0.025	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Acrolein	8260B	0.0083	0.025	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Acrylonitrile	8260B	0.0083	0.025	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Benzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Bromobenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Bromodichloromethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Bromoform	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Bromomethane	8260B	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Butanol	8260B	0.0083	0.025	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Carbon disulfide	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Carbon tetrachloride	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Chlorobenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Chloroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Chloroform	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Chloromethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
cis-1,2-Dichloroethene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
cis-1,3-Dichloropropene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%

TABLE D-4 - QUALITY CONTROL OBJECTIVES

MEDIA: SEDIMENT

Analyte	Method[1]	Target MDL[2] (mg/L)	Target MQL[3] (mg/L)	Max %RSD[4]	Min r (Correl. Coeff)	CCV[5] REC.	Blank Conc. [6]	LCS MS/ MSD REC.[7]	Analytical Dup RPD	Field Dup RPD	SU REC.[7]	IS Area[8]
Dibromochloromethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Dibromomethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Dichlorodifluoro-methane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Ethylbenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Hexachlorobutadiene	8260B	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Isopropylbenzene (Cumene)	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Methyl Acetate	8260B	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Methyl iodide	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Methylcyclohexane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Methylene chloride	8260B	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
n-Butylbenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
n-Propylbenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
o-Xylene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
sec-Butylbenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Styrene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
tert-Butyl methyl ether (MTBE)	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
tert-Butylbenzene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Tetrachloroethene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Toluene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
trans-1,2-Dichloroethene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
trans-1,3-Dichloropropene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
trans-1,4-Dichloro-2-butene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Trichloroethene	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Trichlorofluoromethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Trichlorotrifluoroethane	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Vinyl acetate	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Vinyl chloride	8260B	0.0017	0.005	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Xylene (total)	8260B	0.0033	0.01	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Semivolatile Organics												
1,2Diphenylhydrazine/ Azobenzene	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%

TABLE D-4 - QUALITY CONTROL OBJECTIVES

MEDIA: SEDIMENT

Analyte	Method[1]	Target MDL[2] (mg/L)	Target MQL[3] (mg/L)	Max %RSD[4]	Min r (Correl. Coeff)	CCV[5] REC.	Blank Conc. [6]	LCS MS/ MSD REC.[7]	Analytical Dup RPD	Field Dup RPD	SU REC.[7]	IS Area[8]
2,4,5-Trichlorophenol	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2,4,6-Trichlorophenol	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2,4-Dichlorophenol	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2,4-Dimethylphenol	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2,4-Dinitrophenol	8270C	0.55	1.65	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2,4-Dinitrotoluene	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2,6-Dinitrotoluene	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2-Chloronaphthalene	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2-Chlorophenol	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2-Methylnaphthalene	8270C	0.022	0.066	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2-Nitroaniline	8270C	0.55	1.65	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
2-Nitrophenol	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
3,3'-Dichlorobenzidine	8270C	0.22	0.66	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
3-Nitroaniline	8270C	0.55	1.65	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
4,6-Dinitro-2-methylphenol	8270C	0.55	1.65	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
4-Bromophenyl phenyl ether	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
4-Chloro-3-methylphenol	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
4-Chloroaniline	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
4-Chlorophenyl phenyl ether	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
4-Nitroaniline	8270C	0.55	1.65	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
4-Nitrophenol	8270C	0.55	1.65	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Acenaphthene	8270C	0.016	0.066	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Acenaphthylene	8270C	0.022	0.066	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Acetophenone	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Aniline	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Anthracene	8270C	0.022	0.066	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Atrazine (Aatrex)	8270C	0.22	0.66	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Benzaldehyde	8270C	0.22	0.66	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Benzidine	8270C	0.067	1.32	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Benzo(a)anthracene	8270C	0.022	0.066	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Benzo(a)pyrene	8270C	0.022	0.066	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Benzo(b)fluoranthene	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Benzo(g,h,i)perylene	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%

TABLE D-4 - QUALITY CONTROL OBJECTIVES

MEDIA: SEDIMENT

Analyte	Method[1]	Target MDL[2] (mg/L)	Target MQL[3] (mg/L)	Max %RSD[4]	Min r (Correl. Coeff)	CCV[5] REC.	Blank Conc. [6]	LCS MS/ MSD REC.[7]	Analytical Dup RPD	Field Dup RPD	SU REC.[7]	IS Area[8]
Benzo(k)fluoranthene	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Benzoic acid	8270C	0.55	1.65	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Benzyl alcohol	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Biphenyl	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Bis(2-Chloroethoxy)methane	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Bis(2-Chloroethyl)ether	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Bis(2-Chloroisopropyl)ether	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Bis(2-Ethylhexyl)phthalate	8270C	0.022	0.066	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Butyl benzyl phthalate	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Caprolactam	8270C	0.22	0.66	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Carbazole	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Chrysene	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Dibenz(a,h)anthracene	8270C	0.022	0.066	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Dibenzofuran	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Diethyl phthalate	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Dimethyl phthalate	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Di-n-butyl phthalate	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Di-n-octyl phthalate	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Fluoranthene	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Fluorene	8270C	0.019	0.066	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Hexachlorobenzene	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Hexachlorocyclo-pentadiene	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Hexachloroethane	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Indeno(1,2,3-cd)pyrene	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Isophorone	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Nitrobenzene	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
n-Nitrosodimethylamine	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
n-Nitrosodi-n-propylamine	8270C	0.022	0.066	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
n-Nitrosodiphenylamine	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
o-Cresol	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Phenanthrene	8270C	0.022	0.066	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Phenol	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%

TABLE D-4 - QUALITY CONTROL OBJECTIVES

MEDIA: SEDIMENT

Analyte	Method[1]	Target MDL[2] (mg/L)	Target MQL[3] (mg/L)	Max %RSD[4]	Min r (Correl. Coeff)	CCV[5] REC.	Blank Conc.[6]	LCS MS/ MSD REC.[7]	Analytical Dup RPD	Field Dup RPD	SU REC.[7]	IS Area[8]
Pyrene	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%
Pyridine	8270C	0.11	0.33	15	0.99	+/-20	<MQL	60-140	40	50	60-140	-50 to +100%

Notes:

1. Unless otherwise indicated, analytical methods are from EPA SW-846 "Test Methods for Evaluating Solid Waste."
2. Method Detection Limits are determined by the laboratory using the procedures in 40 CFR Part 136, Appendix B. The MDL listed here is the maximum method detection limit that will support the project performance objectives. Sample Detection Limits (which are adjusted to reflect sample-specific actions, such as dilution or use of smaller aliquot sizes than prescribed in the analytical method, and take into account sample characteristics, sample preparation, sample cleanup, and analytical adjustments including dry-weight adjustments) will be higher.
3. Method Quantitation Limits correspond to the lowest non-zero concentration standard in the laboratory's initial calibration curve calculated using the normal aliquot sizes and final volumes prescribed in the analytical method. The MQL listed here is based on typical laboratory performance. Sample Quantitation Limits (which are adjusted to reflect sample-specific actions, such as dilution or use of smaller aliquot sizes than prescribed in the analytical method, and take into account sample characteristics, sample preparation, sample cleanup, and analytical adjustments including dry-weight adjustments) will be higher.
4. Per the analytical methods for organics, the %RSD for an individual analyte may exceed the criteria as long as the mean %RSD for all calibrated analytes is within the criteria. For data qualification purposes, the %RSD criteria will be applied to each individual analyte and the data flagged accordingly. For GC/MS analyses, the analytical method also includes criteria for the Relative Response Factor (RRF) for a subset of the calibrated analytes. For data qualification purposes, a minimum RRF criteria of 0.05 will be applied to each individual analyte and the data flagged accordingly.
5. Per the analytical methods for organics, the CCV response for an individual analyte may be outside the criteria as long as the mean CCV response for all calibrated analytes is within the criteria. For data qualification purposes, the CCV criteria will be applied to each individual analyte and the data flagged accordingly. For inorganics, the same limits apply for the ICV.
6. Criteria apply for all blank types including method blanks, calibration blanks, equipment blanks, and trip blanks. For data qualification purposes, blank concentrations for all positively identified analytes (i.e., above the detection limit) will be assessed and the data flagged accordingly. However, laboratory corrective action is instituted only for concentrations above the quantitation limit.
7. Criteria are for data qualification purposes. The laboratory shall monitor performance and institute routine corrective action using the laboratory-established limits but the lower limit shall not be below 10% for organics and 30% for inorganics.
8. Expressed as percent of area for internal standard in midpoint calibration standard.

APPENDIX E

QA/QC INFORMATION – FISH TISSUE

TABLE E-1 - ANALYTES AND METHOD SPECIFICATIONS

MEDIA: FISH TISSUE

Intended Use: Quantitative risk assessment - human health

QC Level: Level IV for all sample sets

Laboratory Parameters	Sampling Method	Measurement Technique	Preparation Method SOP	Analysis Method SOP
Chemical Analyses				
TBD[(1)]	BESI-SOP-303; BESI-SOP-304	---	---	---

Note:
1. TBD = To be determined; laboratory parameters will be determined following analysis and review of Intracoastal Waterway sediment data, as detailed in the RI/FS Work Plan.

TABLE E-2 - QUALITY CONTROL OBJECTIVES

MEDIA: FISH TISSUE

Analyte	Method	Method Detection Limit [2]	ICV REC.	CCV REC.	LCS REC.	MS/MSD REC.	MS/MSD RPD	ICB Conc.[3]	Method Blank Conc.
TBD[1]									

Notes:

1. TBD = To be determined; laboratory parameters will be determined following analysis and review of Intracoastal Waterway sediment data, as detailed in the RI/FS Work Plan.
2. Method Detection Limits are determined by the laboratory using the procedures in 40 CFR Part 136, Appendix B and are verified annually by the laboratory. The MDL listed here is the maximum detection limit that will support the project performance objectives.
3. Initial Calibration Standards are prepared at various concentration levels.

TABLE E-3 - SAMPLE CONTAINER, PRESERVATION AND HOLDING TIME REQUIREMENTS

MEDIA: FISH TISSUE

Laboratory Parameters	Container	Preservation	Holding Time
TBD[(1)]	PTFE, G, HRAF	Cool to 4 C or Freeze at ≤ 20 C (archive samples)	See Note 2

PTFE – Polytetrafluoroethylene (Teflon) G – Glass HRAF - Hexane-rinsed aluminum foil

Note:

1. TBD = To be determined; laboratory parameters will be determined following analysis and review of Intracoastal Waterway sediments, as detailed in the RI/FS Work Plan.
2. Holding time depends on selected laboratory analyses that will be identified following evaluation of the Intracoastal Waterway sediment data. Fish tissue samples (finfish and crab) may be archived for up to 6 months prior to analysis (EPA, 2000b. *Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, Volume 1*. OW/EPA 823-B-00-007, November).

TABLE E-4 - FIELD QUALITY CONTROL SAMPLE REQUIREMENTS

MEDIA: FISH TISSUE

Laboratory Parameters	Trip Blanks	Equipment/Field Blanks	Field Duplicates
TBD[1]	TBD	NA[2]	1 per species

Notes:
1. TBD = To be determined; laboratory parameters will be determined following analysis and review of Intracoastal Waterway sediments, as detailed in the RI/FS Work Plan.
2. NA = Not applicable for the sampling techniques.

APPENDIX F

DATA VALIDATION STANDARD OPERATING PROCEDURE

Pastor, Behling & Wheeler, LLC

STANDARD OPERATING PROCEDURE No. 16

FOR DATA VALIDATION

1.0 SCOPE AND APPLICABILITY

This Standard Operating Procedure (SOP) describes a protocol for the validation of analytical laboratory data collected during activities required by the modified Unilateral Administrative Order (UAO) for the Gulfco Marine Maintenance Superfund Site. Included in this protocol are Level III and Level IV procedures to evaluate and validate the completeness, accuracy and precision with respect to the project-specific data quality objectives.

The Quality Assurance Project Plan (QAPP) and applicable SOPs must be reviewed before this SOP is used to assess laboratory data. The individual performing the data reviews shall be familiar with the analytical method and other procedures used for the project. Familiarity with project and laboratory quality control requirements is critical to appropriate use of this procedure.

The individual performing the data reviews must also be familiar with the USEPA National Functional Guidelines (NFG) referenced herein. The SOP provides guidance for application of the data qualifier flags; however, analytical circumstances surrounding sample analyses are variable and the reviewer may need to refer to the National Functional Guidelines for further information.

2.0 DEFINITIONS

Definitions of accuracy, precision and completeness and methods for computing their measures are provided below.

2.1 Accuracy

Accuracy is the degree of difference between the measured or calculated value and the true value. Data accuracy and analytical bias are often assessed by the analysis of laboratory control samples (LCS), matrix spike (MS) samples, and/or surrogate spikes with results expressed as a percentage recovery measured relative to the true (known) concentration.

The percentage recovery for LCS or surrogate spikes is calculated as:

$$\text{Recovery (\%)} = \frac{A}{T} \times 100$$

where: A = measured concentration of the LCS or surrogate; and
T = known concentration.

The percentage recovery for MS samples is calculated as:

$$\text{Recovery (\%)} = \frac{A - B}{T} \times 100$$

where: A = measured concentration of the spiked sample;
B = measured concentration of unspiked sample; and
T = amount of spike added.

Method blanks and equipment blanks are analyzed to quantify artifacts introduced during sampling, transport, or analysis that may affect the accuracy of the data.

2.2 Precision

Precision is the level of agreement between duplicate measurements of the same analyte. Laboratory precision is assessed by determining the agreement of results for replicate measurements of the same sample. Field precision is assessed by determining the agreement for results for two independent samples collected from the same site at the same time. Precision may be evaluated using LCS/LCSD samples, MS/MSD samples, laboratory duplicate samples and/or field duplicate samples.

The relative percent difference (RPD) used to assess precision is calculated as:

$$RPD\ (\%) = \frac{|\ 2\ (S_1 - S_2)\ |}{S_1 + S_2} \times 100$$

where: S_1 = measured sample concentration; and
S_2 = measured duplicate concentration.

2.3 Completeness

Analytical completeness is the percentage of usable (non-rejected) data measurements obtained, as a proportion of the number of planned measurements for the sample set. Analytical completeness is affected by such factors as sample bottle breakage and acceptance/non-acceptance of analytical results. Percentage completeness (C) is calculated as:

$$C\ (\%) = \frac{V}{P} \times 100$$

where: V = number of valid (usable) measurements obtained (all data other than rejected data; and
P = number of measurements planned.

Definitions for the different types of reporting limits are provided below.

2.4 Method Detection Limit (MDL)

The minimum concentration of an analyte that the laboratory can measure and report with 99% confidence that the analyte concentration is greater than zero. The MDL is determined by the laboratory for each analyte in a given reagent matrix (water or soil) generally using the procedures specified in 40 CFR Part 136, Appendix B. It is a measure of the concentration an instrument can detect or 'see' in a given reagent matrix. Project quality objectives include a requirement that the laboratory routinely check the MDL for reasonableness.

2.5 Sample Detection Limit (SDL)

The MDL adjusted to reflect sample-specific actions, such as dilution or use of smaller aliquot sizes than prescribed in the analytical method, and taking into account sample characteristics, sample preparation, and analytical adjustments including dry-weight adjustments. It is a measure of the concentration an instrument can detect or 'see' in a given sample. For this project, non-detects are reported using the SDL.

2.6 Method Quantitation Limit (MQL)

The lowest non-zero concentration standard in the laboratory's initial calibration curve calculated using the normal aliquot sizes and final volumes prescribed in the analytical method. The MQL is a measure of the concentration an instrument can accurately measure in a typical sample.

2.7 Sample Quantitation Limit (SQL)

The MQL adjusted to reflect sample-specific actions, such as dilution or use of smaller aliquot sizes than prescribed in the analytical method, and taking into account sample characteristics, sample preparation, and analytical adjustments including dry-weight adjustments. It is a measure of the concentration an instrument can accurately measure in a given sample. Analytes with concentrations above the SDL but below the SQL, though present in the sample, may not be accurately measured and are thus flagged as estimated (J).

2.8 Data Qualifier Flags

As a result of data validation, data qualifier flags may be applied to individual analytical results. Definitions of the flags applied for data qualification are as follows:

Flag	Definition
J	Analyte confirmed present, but the reported value is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.
J+	The reported value is an estimated quantity, and the result may be biased high.
J-	The reported value is an estimated quantity, and the result may be biased low.

R The data are not usable due to serious deficiencies in meeting quality control criteria. The analyte may or may not be present in the sample.

U Analyte not detected at or above the sample detection limit.

UJ Analyte not detected at or above the sample detection limit, but the reported limit is an estimated quantity. The associated numerical value is an approximate concentration that may be inaccurate or imprecise.

NJ Analyte tentatively identified. Presence of the analyte is not confirmed and the reported value is an estimated quantity.

Note: The J data qualifier may be assigned to laboratory data that was qualified by the lab as an estimated concentration between the laboratory's detection limit and the limit of quantitation.

When an option exists to assign two different flags, the flag higher in the data quality hierarchy will be assigned. The hierarchy is:

R > UJ > U > NJ > J > J+ or J-

Additional explanation regarding assignment of qualifiers, in accordance with the review procedures detailed below, is provided in Table 1.

3.0 PROCEDURES

3.1 Level III Data Validation

A Data Validation Checklist is attached to this SOP. The checklist will be completed to document the data validation process. For Level III validation, the first part of the Data Validation Checklist will be completed according to the following procedure:

(1) Review the Tables in Appendices A through E of the QAPP and note the analytical methods, intended use, target method detection limits, target method quantitation limits, quality control samples and associated control limits specified for each analyte/media.

(2) Review the Chain-of-Custody records (COC). Verify that all necessary information was provided on each COC and that all required signatures are present. Verify that analytical laboratory results were reported for all samples listed on the COCs. Note any problems documented on the COCs by either the sampler or the laboratory.

(3) Verify that field quality control samples were submitted at the project-specified frequency (one equipment blank and one field duplicate per 20 field samples or one per day and one VOC trip blank per shipping container).

(4) Review laboratory records of sample temperature upon receipt and preservation information to verify that samples were properly preserved and VOA vials were completely filled. Verify that samples were received within 2 days of collection. Document any field sample results requiring qualification based on inadequate sample preservation on the Qualified Data Table section of the Validation Checklist.

(5) Briefly summarize the laboratory's case narrative, or note if not present. Summarize any notes or comments documented throughout the laboratory report.

(6) Verify that each sample was prepared and analyzed within the recommended holding time. Document any field sample results requiring qualification based on exceedances of holding time on the Qualified Data Table section of the Validation Checklist.

(7) Review the laboratory method detection limits and method quantitation limits reported by the laboratory against the project evaluation criteria (see the tables in Appendices A through E for each analyte/matrix). Note elevated detection and quantitation limits and assess if the elevated limits are justified by analytical limitations or anomalies. Apply the J data qualifier to all results between the SDL and SQL, as indicated by laboratory J-flag.

(8) Verify the correct field IDs, analytical method references, sample matrix, and proper reporting units were included in the laboratory report. Verify that soil and sediment results are corrected for dry-weight.

(9) Verify that method detection limit studies have been conducted according to the method SOP and have been routinely checked for reasonableness using Detectability Check Samples.

(10) Review the calibration data to ensure proper instrument operating conditions for analysis and quantification of field sample results. Verify the appropriate number of standards was used and the %RSD or correlation coefficient is in compliance with project requirements. Apply data qualifiers to the associated field sample results (those quantitated with the calibration curve) according to the guidelines in Table 1 of this SOP. Refer to the NFG for application of data qualifier flags in the event the situation is not adequately defined in Table 1. Document any field sample results requiring qualification based on calibration data not meeting requirements on the Qualified Data Table section of the Validation Checklist.

(11) For inorganics, verify the initial calibration verification (ICV) was analyzed after the calibration curve and the continuing calibration verification (CCV) samples were analyzed after every ten samples and the recoveries are in compliance with project control limits. Apply data qualifiers to the associated field sample results (those analyzed after the ICV or near the CCV) according to the guidelines in Table 1 of this SOP. Document any field sample results requiring qualification based on ICV or CCV recovery outside control limits on the Qualified Data Table section of the Validation Checklist.

(12) For organics, verify the continuing calibration verification (CCV) samples were analyzed every twelve-hour analytical shift and the recoveries are in compliance with the project control limits. Apply data qualifiers to the associated field sample results (those analyzed on the same shift) according to the guidelines in Table 1 of this SOP. Document any

field sample results requiring qualification based on CCV recovery outside control limits on the Qualified Data Table section of the Validation Checklist.

(13) For inorganics, verify that the initial calibration blank (ICB) was analyzed immediately after the ICV and the continuing calibration blanks (CCB) were analyzed immediately after the CCVs and the concentrations do not exceed the reporting limit. Analysis should be terminated if an ICB or CCB result is greater than the MQL. Apply data qualifiers to the associated field sample results (those analyzed after the ICB or near the CCB) according to the guidelines in Table 1 of this SOP. Document any field sample results requiring qualification based on ICB results on the Qualified Data Table section of the Validation Checklist.

(14) Verify that one method blank was analyzed per analytical batch (maximum 20 samples). Review the results of all method, equipment, and trip blanks and verify that the concentrations do not exceed the reporting limit. Analysis should be terminated if a method blank result is greater than the MQL. If an analyte was detected in a method blank or field blank, check to see if any field sample analyte concentrations associated with that blank were less than five times (ten times for common laboratory contaminants) the blank concentration. If an associated sample result is less than five (or ten) times the blank concentration, the result is potentially biased high and will be qualified as non-detected (less than reporting limit). If an analyte is detected in the method blank and also in an equipment blank, first apply the five times rule using the method blank concentration. The equipment blank results may be considered non-detect due to method blank contamination. Apply data qualifiers to the associated field sample results (those analyzed in the same analytical batch or collected at the same time) according to the guidelines in Table 1 of this SOP. Refer to the NFG for application of data qualifier flags in the event the situation is not defined in Table 1. Document any field sample results requiring qualification based on method blank and/or field blank results on the Qualified Data Table section of the Validation Checklist.

(15) Verify that one LCS was analyzed per analytical batch (maximum 20 samples) and recoveries are in compliance with project control limits. For analytical batches with an LCS and LCSD, compare the mean recovery to the control limits. Deficient LCS recoveries for more than ½ the target analytes for a multi-analyte parameter (VOC, SVOC, etc.) or single recoveries below 30% for inorganics or 10% for organics may indicate serious instrument or calibration problems. The samples should be discarded and the preparation and analysis repeated; however, professional judgment should be used to evaluate whether sample results associated with low-biased LCS recoveries should be rejected or qualified as estimated concentrations with potential low bias. Apply data qualifiers to the associated field sample results (those analyzed in the same analytical batch) according to the guidelines in Table 1 of this SOP. Document any field sample results requiring qualification based on LCS recoveries outside control limits on the Qualified Data Table section of the Validation Checklist.

(16) Verify one MS was analyzed for every twenty field samples and recoveries are in compliance with project control limits. For analytical batches with an MS and MSD, compare the mean recovery to the control limits. MS recoveries outside control limits may indicate possible sample matrix interferences, resulting in qualification of the associated sample results as estimated concentrations with a potential low or high bias. MS recoveries below 30% for inorganics may also indicate serious analytical problems; however, professional judgment (and Post Digestion Spike results, if available) should be used to evaluate whether sample results associated with low-biased MS recoveries should be rejected or qualified as estimated concentrations with potential low bias. Apply data

qualifiers to the associated field sample results (those analyzed in the same analytical batch and with the same sample matrix) according to the guidelines in Table 1 of this SOP. The check is inconclusive and qualifiers are not applied if the amount of the spike is not at least four times the amount in the unspiked sample. Document any field sample results requiring qualification based on MS recoveries outside control limits on the Qualified Data Table section of the Validation Checklist.

(17) Verify one laboratory duplicate, MSD, or LCSD was analyzed for every twenty field samples and the RPDs are in compliance with project control limits; however, if one or both of the results are less than five times the MQL, use the difference in the results with ± 1 times the MQL as the control limit. If an RPD or difference is outside of the control limits, the associated data should be considered estimated values due to poor analytical precision. Apply data qualifiers to the associated field sample results (those analyzed in the same analytical batch and with the same sample matrix) according to the guidelines in Table 1 of this SOP. Document any field sample results requiring qualification based on analytical duplicate RPDs outside control limits on the Qualified Data Table section of the Validation Checklist.

(18) Calculate RPDs for field duplicates and verify they are in compliance with project control limits; however, if one or both of the results are less than five times the MQL, use the difference in the results with ± 2 times the MQL as the control limit for waters and ± 3 times the MQL for soils. Field duplicates measure both field and laboratory precision; therefore the results may have more variability than laboratory duplicates that only measure laboratory precision. If an RPD or difference is outside of the control limits, the associated data should be considered estimated due to poor field and/or laboratory precision. The assessment of field precision will alert the data user to the possible heterogeneity of the sample matrix. Apply data qualifiers to the associated field sample results (those collected at the same time, analyzed in the same analytical batch and with the same sample matrix) according to the guidelines in Table 1 of this SOP. Document any field sample results requiring qualification based on field duplicate RPDs outside control limits on the Qualified Data Table section of the Validation Checklist.

(19) Verify the appropriate surrogates were used for each analysis and recoveries are in compliance with project control limits. Surrogate recoveries below 10% may indicate serious analytical problems. The samples should be discarded and the preparation and analysis repeated; however, professional judgment should be used to evaluate whether sample results associated with low-biased surrogate recoveries should be rejected or qualified as estimated concentrations with potential low bias. Apply data qualifiers to the associated field sample results (those for target analytes of the same type as the surrogate) according to the guidelines in Table 1 of this SOP. The check is inconclusive and qualifiers should not be applied if the surrogates were diluted out of the sample. Note these cases and use the LCS and MS to assess accuracy for the affected samples. Refer to the NFG for application of data qualifier flags in the event the situation is not adequately defined in Table 1. Document any field sample results requiring qualification based on surrogate recoveries outside control limits on the Qualified Data Table section of the Validation Checklist.

(20) Verify the appropriate internal standards were used for each analysis and responses are in compliance with project requirements (within a factor of two of the midpoint calibration standard). Internal standard areas below 25% of those in the calibration standard may indicate serious analytical problems. The sample analysis should be repeated; however, professional judgment should be used to evaluate whether sample results associated with low internal standard areas should be rejected or qualified as estimated concentrations

with potential low bias. Apply data qualifiers to the associated field sample results (those for target analytes quantitated with the internal standard) according to the guidelines in Table 1 of this SOP. Refer to the NFG for application of data qualifier flags in the event the situation is not adequately defined in Table 1. Document any field sample results requiring qualification based on internal standard areas not meeting requirements on the Qualified Data Table section of the Validation Checklist.

(21) Calculate the completeness as defined in Section 2.0 of this SOP. Report the calculated completeness percentage on the checklist. The project completeness goal is 90% on a sample basis and 80% on an analyte basis.

3.2 Level IV Data Validation

For Level IV validation, the first part of the Data Validation Checklist will be completed as above and the second part of the Data Validation Checklist will be completed according to the following procedures:

(1) Verify that the sample results were calculated correctly and transcribed properly from the raw data by checking the values against the instrument printout (taking into account any preparation or dilution factors noted in the laboratory preparation and/or run logs) for 10% of the samples. Check the sample results for reasonableness, i.e. chromatographic profile should be consistent with order of magnitude of results, total metals should not be less than dissolved metals, total metal should not be less than speciated metal, etc.)

(2) Verify that the QC parameters (including ICAL %RSD, RRF, ICV/CCV %R, LCS %R, MS/MSD %R, Duplicate RPD, Surrogate %R, Internal Standard Relative Area, and ICS %R) are calculated correctly by re-calculating the values using data on the instrument printout for one analyte in 10% of the samples.

(3) For pesticides, verify that the pesticide breakdown mixture was analyzed every twelve-hour analytical shift and the recoveries are within the analytical method requirements (less than or equal to 15%). Apply data qualifiers to the associated field sample results (those analyzed on the same shift) according to the guidelines in Table 1 of this SOP. Refer to the NFG for application of data qualifier flags in the event the situation is not defined in Table 1. Document any field sample results requiring qualification based on percent breakdown outside requirements on the Qualified Data Table section of the Validation Checklist.

(4) For GC/MS, verify that the tuning performance solution was analyzed every twelve-hour analytical shift and the ion abundance criteria are within the analytical method requirements. Apply data qualifiers to the associated field sample results (those analyzed on the same shift) according to the guidelines in Table 1 of this SOP. Refer to the NFG for application of data qualifier flags in the event the situation is not defined in Table 1. Document any field sample results requiring qualification based on tuning performance criteria on the Qualified Data Table section of the Validation Checklist.

(5) For GC/MS, verify that the relative response factors (RRF) for the target analytes in each calibration standard are above the minimum project requirements. Low response factors may indicate serious instrument sensitivity problems; however, professional judgment should be used to evaluate whether sample results associated with low calibration RRFs

should be rejected or if it may be possible to elevate the reporting limits to a concentration where an acceptable RRF was obtained. Apply data qualifiers to the associated field sample results (those quantitated with the calibration curve) according to the guidelines in Table 1 of this SOP. Document any field sample results requiring qualification based on low response factors on the Qualified Data Table section of the Validation Checklist.

(6) For ICP metals, verify that the interference check sample (ICS) was analyzed every analytical run and the recoveries are within the analytical method requirements (80-120%). ICS recoveries outside the criteria may indicate a potential bias in sample results due to improper instrument set up. Recoveries below 30% may indicate serious instrument or calibration problems; however, professional judgment should be used to evaluate whether sample results associated with low-biased ICS recoveries should be rejected or qualified as estimated concentrations with potential low bias. Apply data qualifiers to the associated field sample results (those analyzed in the same analytical run) according to the guidelines in Table 1 of this SOP. Refer to the NFG for application of data qualifier flags in the event the situation is not defined in Table 1. Document any field sample results requiring qualification based on ICS recoveries outside criteria on the Qualified Data Table section of the Validation Checklist.

(7) For ICP metals, verify that the initial calibration blanks (ICB), continuing calibration blanks (CCB), and method blanks do not have negative concentrations whose absolute value exceeds the MQL. Negative concentrations above the MQL may indicate a potential low bias in sample results due to improper instrument set up. Apply data qualifiers to the associated field sample results (those analyzed after the ICB, near the CCB, or in the same analytical batch as the method blank) with non-detects or concentrations less than or equal to ten times that in the ICB or CCB according to the guidelines in Table 1 of this SOP. Refer to the NFG for application of data qualifier flags in the event the situation is not defined in Table 1. Document any field sample results requiring qualification based on negative ICP blank results on the Qualified Data Table section of the Validation Checklist.

(8) For GC and GC/MS, verify that the qualitative identification criteria in the analytical method are met for the analytes identified in 10% of the samples. (For GC single-component target analytes, the analyte retention time must be within the daily retention time window and either the identification must be confirmed or the analyte must be known to be present at the site. For GC multi-component target analytes, the retention times of the major peaks must be within the daily retention time window and there must be a clearly identifiable pattern. For GC/MS, the internal standard retention times must be within $\pm$30 seconds of that for the daily standard, the analyte relative retention time must be within $\pm$0.06 units of that for the daily standard, and the intensities of the characteristic ions must be within $\pm$30% of that for the daily standard.) Examine the sample chromatogram for evidence of poor chromatographic performance (abrupt baseline shifts, excessive baseline rise, poor resolution, peak tailing, or peak splitting), evidence of sample carryover, short run times, or undocumented manual integrations. Refer to the NFG for application of data qualifier flags. Document any field sample results requiring qualification based on qualitative identification on the Qualified Data Table section of the Validation Checklist.

(9) For GC with second column/detector confirmation, verify the RPD between the two quantitated results is within the analytical method requirements (less than or equal to 40%). The higher value should be reported unless coelution is suspected. Apply the J data qualifier to all sample results with a high second quantitation RPD. Document any field

sample results requiring qualification based on second quantitation RPD outside criteria on the Qualified Data Table section of the Validation Checklist.

Table 1 provides guidance for application of the data qualifier flags. The table is not intended to include all situations in which a data qualifier flag could be assigned. Analytical circumstances surrounding sample analyses are variable and may result in application of data qualifier flags due to circumstances not detailed on Table 1. Refer to the National Functional Guidelines for further information on application of data qualifiers.

3.4 Documentation of Validation

A Data Validation Checklist will be completed to document the verification of processes and the validation qualifiers assigned to individual results. The checklists will be included in the project file containing the associated laboratory analytical reports.

4.0 DATA USE

Validation qualifier flags are assigned to describe the degree to which individual values provide accurate and precise results. Table 2 lists each of the data qualifier flags and the QC outcomes that may result in the application of that flag. The meaning of the qualifier flags in terms of future data uses are as follows:

Values that are assigned J flags (J, J+, or J-) are considered estimated results. Data assigned these flags indicate that they may not be accurate or precise within the limits specified in the QAPP but that the magnitude of the potential imprecision or inaccuracy is not great enough to reject the value for project data uses.

Values assigned an R flag do not meet the accuracy or precision project requirements specified to provide quantitative data for the project data uses. The R flag indicates that serious deficiencies were encountered preventing the generation of usable data for the project objectives.

Values are assigned U flags when the value is less than the sample reporting limit or to indicate that a low concentration of the analyte cannot be confirmed due to the presence of interference or the presence of the analyte in associated blanks. UJ flags may be applied to indicate values less than the reported limit may not be accurate or precise. Values flagged with U or UJ are fully

usable and should be considered non-detected. The reported numerical result may be used for project objectives.

Values without flags assigned have met all of the project data quality objectives and are suitable for all project data uses.

5.0 QUALITY ASSURANCE

The QA Manager and Project Coordinator will review the completed Data Validation Checklists for conformance with the procedures described herein. Any questions or comments resulting from that review will be resolved before the checklists are considered final. The database manager will modify the project electronic database to include any data qualifiers detailed on a finalized Checklist.

6.0 REFERENCES

USEPA *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, OSWER9240.1-35, EPA 540-R-01-008, October 2004.

USEPA *Contract Laboratory Program National Functional Guidelines for Organic Data Review*, OSWER9240.1-05A, EPA-540/R-99-008 (PB99-963506), October 1999.

Table 1 Guidance for Assignment of Data Qualifier Flags

QC Check	Outcome	Data Qualifier for Results > RL	Data Qualifier for Non-Detects
Hold Time	Exceeds hold time	J	UJ
	Improper preservation	J	UJ
	Grossly exceeds hold time	J	R
Pesticide Breakdown	Excessive DDT or Endrin breakdown	J (parent analyte) NJ (products)	R (parent analyte)
GC/MS Tune	Outside ion abundance criteria	J	UJ
ICAL	%RSD or r exceeds criteria	J	UJ
	RRF below limit	J	R (or elevate RL)
ICV/CCV	%R outside criteria	J	UJ
ICB/CCB	Sample result $\leq$ 1x blank value	U	none
	Absolute value of negative ICP blank result > MQL	J- (if result < 2x MQL)	UJ
Method or Field Blank	Sample result $\leq$ 5x (10x for common laboratory contaminants) blank value	U	none
	Absolute value of negative ICP blank result > MQL	J- (if result < 2x MQL)	UJ
LCS	Recovery <30% (inorganics) or <10% (organics)	J-	R
	Recovery below limit	J-	UJ
	Recovery above limit	J+	none
Matrix Spike[(1)(2)]	Recovery <30% (inorganics only)	J-	R
	Recovery below limit	J-	UJ
	Recovery above limit	J+	none
Analytical Duplicate[(1)]	Result $\geq$ 5x MQL and RPD exceeds criteria	J	none
	Result < 5x MQL and Difference exceeds criteria	J	UJ

Field Duplicate[1]	Result ≥ 5x MQL and RPD exceeds criteria	J	none
	Result < 5x MQL and Difference exceeds criteria	J	UJ
Surrogate[3]	Recovery <10%	J-	R
	Recoveries below limit[4]	J-	UJ
	Recoveries above limit[4]	J+	none
	Recoveries above and below limit[4]	J	UJ
Internal Standard[5]	Area response <25%	J	R
	Area response below limit	J	UJ
	Area response above limit	J	none
ICP ICS	Recovery <30%	J-	R
	Recovery below limit	J-	UJ
	Recovery above limit	J+	none
GC Second Quantitation	RPD > 40%	J	none

(1) Flagging applies to samples with the same matrix.

(2) Check waived if the amount of the spike is not at least four times the amount in the unspiked sample.

(3) Flagging applies to target analytes of the same type as the surrogate (e.g., acid or B/N for SVOC). Check waived if surrogates diluted out of sample.

(4) For methods with multiple surrogates, flagging applies only if more than one surrogate of a particular type is deficient.

(5) Flagging applies to target analytes quantitated with the internal standard.

Table 2 Guidance for Interpretation of Data Qualifier Flags

Data Qualifier Flag Assigned	PBW Standard Procedure No. 20 Guidance for Interpretation of Data Qualifier Flags
U	Sample result <RL Sample result >RL and less than 5-10x highest associated blank concentration
J	Sample result >RL and holding time exceeded or improper preservation Sample result >RL and instrument calibration or performance does not meet requirements Sample result ≥5x MQL and analytical duplicate RPD outside control limits Sample result between RL and 5x MQL and difference for analytical duplicates greater than ± 1x MQL Sample result ≥5x MQL and field duplicate RPD >50% Sample result between RL and 5x MQL and difference for field duplicates greater than ± 2x MQL (waters) or ± 3x MQL (soils)Sample result>RL and internal standard area outside control limits Sample result between RL and MQL and assigned a "J" qualifier by the laboratory indicating an estimated concentration
R	Holding time grossly exceeded Serious quality deficiency resulting in unusable data such as very low instrument response or spike recovery
UJ	Sample result <RL and holding time exceeded or improper preservation (option to assign R for gross exceedance of holding time) Sample result <RL and instrument calibration or performance does not meet requirements (option to assign R for very low instrument response) Sample result <RL and LCS, MS, surrogate, or ICS recovery below control limits (option to assign R for very low recovery) Sample result<RL and internal standard area below control limits (option to assign R for very low response)
J-	Sample result >RL and LCS, MS, surrogate, or ICS recovery below control limits
J+	Sample result >RL and LCS, MS, surrogate, or ICS recovery above control limits
NJ	Sample result > RL and identification criteria not met or identification not confirmed.

FIGURE SOP 16-1. DATA VALIDATION CHECKLIST

DATA VALIDATION CHECKLIST (Level III and Level IV)				
Client Name:	Project Number:			
Property Location:	Project Manager:			
Laboratory:	Laboratory Job No.:			
Reviewer:	Date Checked:			
ITEM	**Yes**	**No**	**NA**	**Comment Number**
Chain of Custody (COC) and Sample Receipt at Lab				
1. Signed COCs included and seals used?				
2. Date and time of sample collection included?				
3. All samples listed on the COC analyzed for in accordance with the RI/FS Work Plan?				
4. Field QC sample frequency met project requirements?				
5. Sample receipt temperature 2-6°C?				
6. Samples preserved appropriately?				
7. Samples received within 2 days of collection?				
8. Any problems noted?				
Laboratory Report and Data Package				
9. Signed Case Narrative included?				
10. Analytical discrepancies noted in case narrative?				
11. Field sample IDs included?				
12. Laboratory sample IDs included?				
13. Date of analysis included?				
14. Date of sample preparation included?				
15. Samples prepared within holding time?				
16. Samples analyzed within holding time?				
17. Detection limit and quantitation limit included?				
18. Project target limits achieved?				
19. Elevated reporting limits justified?				
20. Method references included?				
21. Sample matrix included?				
22. Sample result units reported correctly?				
23. Soil/ sediment results corrected for dry-weight?				
24. MDLs reasonable per DCS?				
25. Calibration data acceptable?				
26. ICV and CCV recoveries within project control limits?				
27. ICB and CCB results <RL?				
28. Method blank results <RL?				
29. Equipment and Trip blank results <RL?				
30. All COIs included in LCS?				
31. LCS recovery within project control limits?				
32. MS/MSD recoveries within project control limits?				
33. LCS/LCSD RPDs within project control limits?				
34. MS/MSD RPDs within project control limits?				
35. Laboratory duplicate RPDs within project control limits?				
36. Field duplicate RPDs within project control limits?				
37. Surrogate recoveries within project control limits?				
38. Internal standard areas within project control limits?				

FIGURE SOP 16-1. DATA VALIDATION CHECKLIST

39. Completeness percentage within project limits?				
Definitions: **CCB** – Continuing Calibration Blank; **CCV** – Continuing Calibration Verification; **COI** – Compounds of Interest; **DCS** – Detectability Check Sample; **ICB** – Initial Calibration Blank; **ICV** – Initial Calibration Verification; **LCS** – Laboratory Control Sample; **LCSD** – Laboratory Control Sample Duplicate; **MDL** – Method Detection Limit; **MS/MSD** – Matrix Spike/Matrix Spike Duplicate; **RL** – Reporting Limit; **RPD** – Relative Percent Difference				
COMMENTS				

FIGURE SOP 16-1. DATA VALIDATION CHECKLIST

DATA VALIDATION CHECKLIST (Level IV only)				
Client Name:	Project Number:			
Property Location:	Project Manager:			
Laboratory:	Laboratory Job No.:			
Reviewer:	Date Checked:			
ITEM	**Yes**	**No**	**NA**	**Comment Number**
Laboratory Report and Raw Data Package				
1. Sample results calculated and transcribed correctly?				
2. QC parameters calculated and reported correctly?				
3. Pesticide breakdown $\leq$ 15%?				
4. GC/MS tuning performance within criteria?				
5. GC/MS RRF above minimum project requirements?				
6. ICP ICS recoveries within criteria?				
7. ICP ICB/CCB absolute value of results <MQL?				
8. GC qualitative identification criteria met?				
9. GC/MS qualitative identification criteria met?				
10. GC second confirmation %D criteria met?				
COMMENTS				

FIGURE SOP 16-1. DATA VALIDATION CHECKLIST

QUALIFIED DATA TABLE		
Field Sample Identification	**Assigned Data Qualifier**	**Reason for Qualification**

APPENDIX G

ANALYTICAL LABORATORY
QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROGRAM PLAN

FOR

GCAL Inc.
7979 GSRI Avenue
Baton Rouge, Louisiana 70820

Revision 24
August 26, 2004

Approval Signatures:

10/6/04
Date
President

10/06/04
Date
Operations Manager

10/6/04
Date
QA/QC Director

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1.0 QUALITY ASSURANCE POLICY STATEMENT

Quality Assurance consists of a planned system of activities necessary to provide confidence in the results of laboratory analytical determinations. The principal objective of GCAL is the production of high quality analytical data through the use of measurements that are accurate and reliable for the intended purpose. We are dedicated to providing analytical data and services that conform to all of the requirements specified and expected by our clients. This Quality Assurance Program Plan details facilities, personnel and equipment necessary for accomplishing this objective along with general procedures and practices that will be followed to maintain adherence to the objective. All policies and procedures have been structured in accordance with the NELAC standards adopted in July 1999 and in accordance with applicable state, EPA, and other regulatory agency requirements, regulations, methods, and guidance.

There is a commitment and dedication by all laboratory staff to produce data of known and documented quality. This commitment and dedication to quality is fully supported from the bench level to upper management in order to meet the objectives of our laboratory and best serve our clients.

GCAL's approach to Quality Assurance starts with the General Manager who delineates policy and sets goals in conjunction with senior management personnel. Policies are implemented by management staff and laboratory personnel. All departments are involved in the process by providing assessment of operating procedures along with recommendations for improvements or corrections. The QAPP and the appropriate Standard Operating Procedures are distributed to all laboratory personnel as controlled documents according to SOP QA-001 (Document Control). All personnel are required to read and comply with this program.

The Quality Assurance/Quality Control Director, who reports directly to the General Manager, oversees prevention, assessment, and correction procedures for the analytical laboratory and various associated departments within the organization. These three functions; prevention, assessment, and correction, comprise the foundation of the laboratory's approach to Quality Assurance.

Prevention covers positive actions taken before or during analyses to insure that the analytical systems are functioning properly. Prevention includes such things as instrument calibration and maintenance, frequent standardization, personnel training and quality control planning.

Assessment is a component of quality control that includes monitoring of performance to determine precision and accuracy. Examples include duplicate and spike analyses, check samples, peer review of calculations and validation of methodology.

Correction is action taken to determine the causes of quality defects and to restore proper functioning of the analytical system. This may involve trouble shooting to correct instrument

malfunctions, or retraining of personnel.

All quality assurance activity requires constant monitoring and documentation to provide evidence of consistent, valid analytical data. GCAL keeps records of such activities in order to have available for its clients documented assurance that the data they receive quantitatively reflect the parameters requested.

The policies and practices of quality assurance/quality control presented in this plan are set forth as minimums. Additional quality assurance/quality control measures may be required for a specific project.

2.0 ETHICS POLICY

GCAL utilizes a clearly stated ethics policy in the form of the following Ethics and Data Integrity Statement. This agreement is discussed with all new employees during orientation and is then signed and retained with the employee's training file. Violation of the agreement is basis for termination of employment.

GCAL

ETHICS AND DATA INTEGRITY AGREEMENT

I, _____, state that I understand the high standards of integrity required of me with regard to the duties I perform and the data I report in connection with my employment at GCAL. Our core values are honesty, success, service and integrity, I understand that it is critical for our long-term success that each and every employee align with all company core values.

I agree that in the performance of my duties for GCAL and its clients, I shall conform to the following ethics standards and will report immediately to the Quality Assurance Manager and the appropriate supervisor any information concerning misrepresentation of analytical data that includes, but is not limited to:

1) Altering an instrument computer or clock for any inappropriate purpose;

2) Altering the contents of logbooks and/or data sheets to misrepresent data;

3) Misrepresenting an analyst's identity;

4) Changing raw data documents with correction fluid;

5) Preparation and submittal of "fake" data packages;

6) Inappropriate calibration techniques such as peak shaving, setting fraudulent integrator parameters, or use of computer macros that alter QC results.

7) Changing reported results without proper documentation and approval;

8) Altering injection volumes for calibration and misrepresenting the true values;

9) Failure to comply with standard operating procedures or methods without proper documentation and approval;

10) Any attempt to misrepresent data or events as they actually occur in the course of data production, review or reporting;

11) Disposing of or deleting electronic data files or hardcopy of raw data;

12) Engaging in any practice that ultimately misrepresents data or narratives in any way.

I will not knowingly participate in any such activity and will not tolerate unethical practices by others. I understand that confidentiality will be strictly enforced by GCAL when dealing with these matters. As a further extension of my commitment to this program, I am responsible for seeking approval to report data resulting from techniques or procedures that may deviate from standard operating procedures, methods, or industry standard practices. Any such reporting of data will include a laboratory narrative that must be approved by the appropriate supervisor and the QA Manager.

If I am unsure of how to properly handle data generated by me, I am responsible for seeking advice and approval from the Quality Assurance Manager and the appropriate supervisor. I agree to inform the Quality Assurance Manager and the appropriate supervisor of any accidental reporting of non-authentic data by myself or others within 24 hours of discovery.

I understand that if I knowingly participate in any such prohibited activity, I will be subject to serious disciplinary action that may include termination by GCAL. I also understand that I face individual suspension and debarment from all Federal programs should I be convicted of such practices. I understand that suspension and debarment from all Federal programs affects my ability to work in the environmental field, as well as, any other professions where government funding or loans may be involved. I understand the most serious consequence of unethical conduct can be imprisonment if convicted.

However, it is not the company's intent to punish anyone for an accidental mistake or oversight. Employees will not face disciplinary actions in this case. Repeated careless or neglectful behavior will be subject to corrective action. Covering up a mistake or oversight is not acceptable behavior and will result in termination. Mistakes or oversights should be immediately reported to the Quality Assurance Manager and the appropriate supervisor.

My signature affirms my understanding of the consequences of violating this "ETHICS AND DATA INTEGRITY AGREEMENT" and my commitment to its intent. My signature further affirms that I have received formal training on this topic.

_____
(Signature)

_____
(Date)

3.0 QUALITY ASSURANCE MANAGEMENT

3.1 Quality Assurance Responsibilities

The direct and ultimate responsibility for assuring data quality at GCAL rests with the General Manager. The General manager develops policies and general quality assurance strategies in collaboration with the Operations Manager, QA/QC Director, and Department Supervisors (GCMS-SVOA, GCMS-VOA, GC, Metals, Sample Preparation/Extractions, General Chemistry, Sample Management).

GCAL has clearly defined staff Quality Assurance (QA) responsibilities. The first level of QA lies with the laboratory analyst, who is responsible for performing the work properly, documenting it, and obtaining peer review to assure that it meets scientific standards. To accomplish this, the analyst must have a clear understanding of the analytical techniques and procedures used and the factors which affect the quality of the results. Analysts' capabilities are verified prior to conducting analyses and reviewed periodically thereafter.

Analysts must have a working knowledge of the QA policies, including data quality objectives for laboratory control standards, duplicates, and spikes; an understanding of detection limits and standard calibration requirements; and a knowledge of preventive maintenance techniques.

The second level of quality assurance lies with the management staff which includes Department Supervisors. Management is responsible for the proper training of analysts and stresses the importance of accuracy and reliability of results. Management is responsible for the quality of all analytical data produced. This responsibility includes routine review and approval or disapproval of all data and inspection of the QC records associated with the data. If the data are not adequately substantiated, corrective action is taken.

The QA/QC Director supports the entire process of the QA/QC program. This includes administration of the program as outlined in this manual, maintenance of QA records including this QAPP and preparation of reports to management covering QA activities. The QA/QC Director performs periodic audits of the QA procedures and staff, and coordinates all performance audits (e.g. check sample programs). The QA/QC Director will also assist in the preparation of QA programs to fit specific needs of clients, or for bid proposals.

3.2 Quality Assurance System

3.2.1 Personnel Training

It is the policy of GCAL to hire employees with an educational background and/or experience in an analytical field. On-the-job training takes place for all new employees based on needs identified by the job description and tasks of the position.

The training program begins with an orientation program designed to familiarize the new employee with safety and chemical hygiene issues, the importance of QA/QC in the analytical laboratory, general laboratory procedures, and company policies. All employees undergo training in ethical and legal responsibilities including the potential penalties for improper, unethical, or illegal actions. Each employee must read and sign an Ethics and Data Integrity Agreement. All technical personnel undergo a training process involving twelve lecture tapes covering basic laboratory functions. A written test follows each lecture tape.

New employees are under the supervision of experienced analysts and/or the department supervisors who are responsible for showing them the analytical procedures including the applicable QA/QC. This training includes review of the Standard Operating Procedure (SOP) and applicable instrumentation or equipment. Manuals for various methods are readily available to supplement the SOP for each analysis. Among the manuals are current copies of the EPA Test Methods for Evaluating Solid Waste (SW846), Chemical Analysis for Water and Wastes, Standard Methods and applicable ASTM methods. The analyst will perform an acceptable initial demonstration of capability before the institution of a test method. This is accomplished by analyzing four laboratory control samples (LCS) and verifying that the precision and accuracy requirements of the laboratory or method have been met. This demonstration will be repeated whenever there is a significant change to the instrument or test method.

GCAL also recognizes development training as a means to increase the effectiveness of the employee and the organization. Therefore, GCAL utilizes other applicable training methods along with on-the-job training. Examples of this are seminars, specialized training by instrument manufacturers, internal training courses, and encouraging the employees to take related college courses. On-going proficiency is documented by performance evaluation samples, an annual demonstration of capability, and /or analysis of blind samples.

Training is also necessary for an employee whose performance does not meet standard requirements. This deficiency may be identified in a performance appraisal or through the occurrence of problems.

New employees are hired for a probationary period of three months. At the end of three months the employee's records are reviewed and evaluated for performance and productivity and a decision is made whether to continue employment.

Periodic reviews are given to all personnel. The purpose of these reviews is to give recognition for good work and outline personnel and departmental objectives, suggestions for improvement and clarification of responsibilities. Other topics which concern either employee or employer are also discussed at this time.

Training files are maintained for each employee. The records include the demonstration of capability, performance evaluation and blind study results, training course certificates, in-house or external training seminar documentation, and ethics and manual integration agreements.

A demonstration of continued proficiency is performed annually by each analyst. Documentation is included in the analyst's training file. This is performed in one of the following:

- ❖ acceptable performance of a blind sample
- ❖ another demonstration of capability (analysis of four LCSs with acceptable levels of precision and accuracy
- ❖ succesful analysis of a blind performance sample on a the method or similar test method (e.g., GCMS Volatiles 8260B/624)

3.2.2 Procurement and Inventory Control

Chemical reagents, solvents, gases, glassware and general chromatographic supplies are ordered as needed to maintain sufficient quantities on hand for use. Purchase orders are maintained as an inventory control of materials ordered by the laboratory. All orders are processed through central receiving and routed to the appropriate departments. Routine supplies are maintained on site in an inventory control stock room.

The grade or purity ordered varies depending on the analytical requirements. Standards and reagents are purchased from laboratory approved vendors. All reagents must meet A.C.S. (American Chemical Society) Reagent Grade specifications or better and all purchased standards are NIST traceable (if available). Chemical reagents and standards are dated when received and/or prepared in the laboratory and stored according to manufacturers suggestions. Flammable cabinets are available for hazardous reagents. Several refrigerators and freezers are in use to prevent contamination or deterioration. Incompatible reagents are stored separately. Prepared reagents and standards must include the name, concentration, and expiration date (if applicable).

For all analyses, an independent standard (ICV-second source or lot#) is analyzed after each initial calibration. This standard must meet the criteria established for each analytical method.

It is the responsibility of the analyst to maintain the integrity of all chemicals used and notify the head of purchasing when standards or reagents do not meet specification so that corrective action can be taken. It is also the responsibility of the analyst to contact purchasing ahead of time before supplies are actually needed.

The purchase of analytical instrumentation is based on anticipated sample volume and the need to maintain superior quality data. Specifications are carefully examined to be sure new in-

strumentation meets current and anticipated needs. Warranty and service contract information is gathered at the time bids are reviewed and this information is considered in making the final selection. An extensive performance check-out before the instrument is accepted is mandatory. New equipment must undergo a rigorous method validation before being put into production. Operators of new instruments are sent to training courses if necessary.

Inventory records are maintained for all major capital equipment. Major suppliers of consumable items are:

Allometrics	Templet & Templet	Dionex
Fisher Scientific Company	Supelco	CPI
Environmental Express	Perkin-Elmer	Shimadzu

3.2.3 Standards for Analysis

Preparation of standards for calibration must be made from pure materials (of known purity, 98% or better preferred) or from purchased concentrates certified by NIST, EPA, or other acceptable agencies.

All solvents used for preparation of standards for GC, GCMS, and HPLC are of pesticide grade. All standards, reagents, and solvents used for trace metal analysis must be trace-metal grade.

Stock standards can be kept up to one year if no expiration date is indicated by the manufacturer. All standards must be stored under conditions which provide the best protection against contamination and deterioration. Upon preparation of the standard, the following items must be recorded on the bottle containing the standard: laboratory assigned ID, standard name, concentration, initials of the analyst preparing the standard, date prepared, and expiration date. All other information regarding the standard including solvent used, lot number(s) of solvent used, the analyte source, purity and lot number, expiration date, concentration, dilution procedure, analyst's initials, and date prepared must be entered in the log book (see Miscellaneous Forms at the end of this manual).

Preparation of intermediate standard solutions is necessary for many tests. These working standards include calibration standards, spiking solutions, surrogate solutions, internal standard solutions, etc., and must be stored as required when not in use. Working standards for the analysis of volatile organic constituents must be prepared at least once in two weeks. Working standards for the analysis of semi-volatile organic constituents and pesticides must be prepared as needed or every six months.

Working standards for trace metal analysis should be prepared at least once a month for concentrations of 1 mg/L and less. Calibration standards for mercury are digested as needed and calibration standards for graphite furnace are prepared daily.

The identification of each standard prepared must be unique and all documents related to sample analysis in which the standard was used must contain this unique identification. The document should be such that all of the standard information could be traced from the raw data for the sample.

Freezers and refrigerators are designated for storage of standards. Samples are not stored with standards.

3.2.4 Equipment Operation, Calibration and Maintenance

Equipment is defined as any non-disposable mechanical and/or electronic device used in the generation or measurement of data.

The calibration of instruments and support equipment is required to ensure that the analytical system is operating correctly and functioning within acceptable precision, accuracy and sensitivity limits. Calibration is defined as the systematic determination of the relationship of the response of the measurement system to a known standard. The calibrations or calibration checks are performed with reference standards traceable to primary standards (e.g. NIST or other certified standards). If traceable chemical standards are not available, standards may be prepared according to the laboratory quality control procedures or the project's requirements. The calibration requirements for each type of equipment or instrument are defined in the standard operating procedures. Additionally, specific requirements may be defined in a project plan.

1. Equipment for the generation, measurement or determination of data shall be adequately calibrated.

2. Equipment shall have adequate procedures for operation, calibration, maintenance and quality control which shall:
   -Be prepared in written form as an SOP
   -Be congruent with the manufacturer's recommendations
   -Reflect actual use patterns for the equipment
   -Establish frequency intervals particular to the equipment

3. Equipment shall be calibrated and maintained in accordance with the procedures and schedules detailed in the equipment SOP.

4 Calibration and maintenance intervals begin from the date of last calibration or service.

5. Equipment maintenance shall be documented and the records retained in accordance with the logging requirements of the SOP, in the respective equipment file.

The Operations Manager and/or the Department Supervisor shall:
- Identify, compile and write the SOP
- Make pertinent SOP's available to the appropriate staff (This is to be coordinated with the QA Manager)
- Maintain instrument SOP's with the equipment or instruments. Operation manuals shall also be available in the immediate work area. The Department Supervisor is responsible for verifying that the manufacturer's manuals are kept up-to-date by replacing obsolete information with updates provided by the manufacturer.
- Ensure that the logbooks are initiated and maintained in accordance with the SOP's
- Review records for completeness and accuracy, which indicates the equipment, is in proper working order.
- Monitor and assure compliance with the SOP.

The Quality Assurance Department shall:
-Coordinate SOP preparation.
-Coordinate review/revision of SOP's.
-Reproduce and issue SOP's.
-Retain current and historical copies of the SOP's.
-Maintain distribution list of issued SOP's. Recall superseded copies.
-Verify compliance (via inspections).

The calibration of analytical balances is verified daily before use at a mass or masses that bracket the measurements performed on the balance. NIST traceable weights are used for the verification. The balance verifications are documented in a logbook assigned to each balance. The acceptance criteria for the verification is based on the balance sensitivity requirement and the particular weight and is documented in the front cover of each log book.

All refrigerators and freezers are monitored for proper temperature by measuring and recording internal temperatures on a daily basis. The temperatures are documented in a logbook assigned to each refrigerator or freezer. The acceptance criteria for the temperatures is identified in the logbooks. Thermometers are checked at least annually against a NIST traceable thermometer.

The calibration of variable volume mechanical pipets is performed at one to three volumes that bracket the range of use on the day of use. Fixed volume mechanical pipets are verified monthly. The accuracy of non-standard labware is verified gravimetrically unless the manufacturer supplies the accuracy tolerances. All gravimetric verifications are documented in a logbook.

Other support equipment such as ovens, waterbaths, and digestion blocks are monitored for compliance with the specified temperature ranges. All checks are documented in the appropriate logbook.

Calibration of an instrument is accomplished by relating a response to a concentration of an analyte. Each SOP defines the requirements for the initial calibration curve such as the number of standards, the acceptance criteria and the frequency for calibration. On a daily basis, the calibration of the instrument must be verified at the concentration and frequency

defined in the SOP.

Maintenance is defined as cleaning and/or replacing equipment components to assure that the equipment has been properly and periodically serviced and is in satisfactory condition.

It is the responsibility of the analyst to verify that the instrument configuration and operating conditions used satisfy the analytical requirements and to maintain quality control data confirming instrument performance and analytical results.

If equipment outside the permanent control of the laboratory is utilized, it must meet the same criteria above. The laboratory shall ensure that the function and calibration status of the equipment is checked and shown to be satisfactory before it is put into service. The equipment must meet all requirements of LADEQ regulations/NELAC standards.

3.2.5 Reporting and Recording Data

All raw data is recorded in bound books and/or by instrument printout. This includes such information as standard curves, matrix spikes, duplicates, reagent blanks, calculations and any notations concerning a given analysis. All preventive maintenance information is recorded in a logbook assigned to each instrument.

When analyses are complete, the information is downloaded or manually entered into the LIMS. The data is then reviewed and authorized by the Department Supervisor. The final report is then printed. GCAL has the capabilities to produce several levels of reports. These include a LIMS report with batch QC, a CLP like forms package, and a full CLP like deliverable package. The level of reporting should be specified when the samples are submitted. After the complete package is assembled, the data validation manager or his designee will review the data. Only after the reports have been authorized and signed by the Operations Manager or his designee are they released to the client. After final approval of the reported data, various electronic deliverable formats can be produced to submit data by electronic means.

The laboratory will retain all records related to sample analysis including raw test data, calculations, derived data, calibrations and copies of test reports. These records will be stored in systematic manner for a minimum of five years. Longer periods of storage may be arranged at the time of a project initiation. If the laboratory is going out of business, clients will be notified at least 60 days (if time permits) prior to closure of the laboratory and will receive a final report for all submitted samples. The client notification will request instructions on the retention or distribution of laboratory records and will provide contact information for after the closure.

Additional information is kept in-house for documentation of control. This includes performance evaluation reports, equipment and supplies inventory, control charts for laboratory control samples, matrix spikes and duplicates, quality assurance audits, standards as knowns, standards as blinds and method validations. This information is used by management to track the progress and needs of the corporation.

3.3 Quality Assessment

Quality assessment is accomplished by monitoring the accuracy, completeness, and precision of the quality control data, such as blanks, calibration curves, duplicates, spikes, internal standards or surrogates. Additionally, system audits, standards as knowns and standards as blinds may be used to validate the correctness of numerical computations. Other tools are preventive maintenance, performance evaluations and chain-of-custody procedures. By proper maintenance of these tools, the entire system of data production is verified.

3.3.1 Processing of Quality Control Data

This section describes the analytical treatment of the data resulting from the quality control samples through specific routine procedures used to assess data precision and accuracy.

A reagent and/or method blank is prepared and analyzed with each set of samples. Field blanks (if provided by the client) are analyzed to determine possible sample contamination during collection and shipment to the laboratory. Trip blanks are applicable to volatile organics analysis (VOA) where volatile contaminants can be introduced from ambient air on site, during shipment, and in the laboratory.

A Laboratory Control Standard (LCS) consisting of an interference free matrix spiked with the analytes of interest or a representative list of the analytes of interest is prepared and analyzed with each batch of twenty or fewer samples. Analyte-free reagent water is used for water samples. A purified solid matrix such as Ottawa sand or sodium sulfate is used for soil or solid samples. For those tests that it is difficult to obtain a suitable solid matrix for spiking, analyte free reagent water is taken through the preparation and analysis procedure. The LCS may also be a standard reference material. A matrix spike (a sample to which known concentrations of target analytes have been added before sample manipulation) is performed on one sample in each batch of twenty or fewer samples for those tests that spiking is applicable. A duplicate for each matrix type is included in each batch of twenty or fewer samples. Routinely, the laboratory includes a matrix duplicate (a sample the laboratory divides into two aliquots) in inorganic test batches and a matrix spike duplicate (a duplicate of the matrix spike) in organic test batches. The type of duplicate to include in a batch may be modified based on specific project requirements. Additionally, a matrix duplicate may be performed instead of matrix spike duplicate if it is known that the target analytes are present in the sample and a matrix spike duplicate may be performed instead of a matrix duplicate if it is known that target analytes are not present in the sample. A Laboratory Control Standard Duplicate (LCSD) is included if insufficient sample is available to perform a duplicate on a sample.

If required by the method, each sample is spiked with the appropriate surrogate standards prior to extraction and analysis for all organic compounds analysis. Internal standards are added to all samples for GC Volatiles, GC/MS Volatiles and GC/MS Semi-volatiles testing prior to analysis. A continuous flow internal standard is used for ICP analysis.

When the analysis of a sample set is completed, the results will be reviewed and evaluated to

assess the validity of the data set. Review is based on the following criteria:

Reagent Blank Evaluation - The reagent and/or method blank results are evaluated for high readings characteristic of background contamination. If high blank values are observed, laboratory glassware and reagents should be checked for contamination and the analysis halted until the system can be brought under control before further sample analysis proceeds. The concentration of an analyte in a reagent blank must be less than ½ the reporting limit or less than 5% of the analyte detected in the associated samples.

Field Blank Evaluation - Field blank results are evaluated for high readings similar to the reagent and/or method blanks described above. If high field blank readings are encountered, the procedure for sample collection, shipment, and laboratory analysis should be reviewed. If both the reagent and/or method blanks and the field blanks exhibit significant background contamination, the source of contamination is probably within the laboratory. In the case of VOAs, ambient air in the laboratory and reagents should be checked as possible sources of contamination.

Calibration Standard Evaluation - The calibration curve is evaluated to determine linearity through its full range, and that sample values are within the range defined by the low and high standards. If the curve is not linear, sample values must be corrected for nonlinearity by deriving sample concentrations from a graph or by using an appropriate algorithm to fit a nonlinear curve to the standards.

Duplicate Sample Evaluation - Duplicate sample analysis for the sample set is used to determine the precision of the analytical method for the sample matrix. The duplicate results are used to calculate the precision as defined by the relative percent difference (RPD). If the RPD is above the control limit, the sample set may be re-analyzed for the parameter in question or the failure is documented in the case narrative.

Matrix Spike Evaluation - The observed recovery of the spike versus the theoretical spike recovery is used to calculate accuracy as defined by the percent recovery. If the accuracy value exceeds the control limits for the given parameter, the LCS is reviewed to verify the analytical system is in control. The failure may be a result of an error or the matrix. If the accuracy value exceeds the control limit, the sample set may be reanalyzed for the parameter in question.

Reference Standard Evaluation - Standard Reference Materials analyses are compared with true values and acceptable ranges. Values outside the acceptable ranges require corrective action to determine the source of error. All sample analyses should be halted pending this evaluation. Following correction of the problem, the SRM should be reanalyzed.

Laboratory Control Standard Evaluation - The results of check standard analyses are compared with the true values and the percent recovery of the check standard is calculated. If correction is required, the check standard should be reanalyzed to demonstrate that the corrective action has been successful. Control chart data is reviewed periodically to verify the laboratory is

performing within the established control limits.

Surrogate Standard Evaluation - The results of surrogate standard determinations are compared with the true values spiked into the sample matrix prior to extraction and analysis. The percent recoveries of the surrogate standards are calculated and reported with the sample results. If recoveries are outside the control limits, re-preparation and analysis may be required. The specific corrective action required is documented in each applicable SOP.

Additional data validation is accomplished by participation in performance evaluations such as those sponsored by EPA approved suppliers which provide further review for in-house QA/QC procedures.

3.3.2 Statistical Quality Control

As part of the analytical quality control program, the precision and accuracy for each analytical method is established by the use of control charts. This may include only a subset of the target analytes. The charts are used to assess the method performance over a period of time. A minimum of twenty measurements of precision and accuracy are used to establish a chart. In general, control limits of ±three standard deviations are utilized.

Control charts are developed to predict trends (positive or negative) in the analytical processes and to determine when an analysis is out of control.

Examples of situations which may show up in control charts are:

- Shift in mean - this may be caused by incorrectly prepared standards or reagents, contamination of sample, problems in instrument calibration, or analyst error.
- Trend of mean upward - this may be caused by deterioration of standards or reagents.
- Trend of mean downward - this may be caused by concentration of standard due to evaporation of solvent or deterioration of reagents.
- Increase in variability - this may be caused by poor technique by the analyst or deviation from procedure.

3.3.2.1 Precision

Precision is the measure of how closely multiple analyses of a particular sample agree with each other. To determine the precision of the method and/or laboratory analyst, a routine program of duplicate analyses is performed. The results of the duplicate analyses are used to calculate the relative percent difference (RPD), which is the governing quality control parameter for precision.

The relative percent deviation (RPD) for duplicate analyses is defined as 100 times the difference (range) of each replicate set, divided by the average value (mean) of the duplicate set.

3.3.2.2 Accuracy

In addition to the evaluation of analytical precision, GCAL evaluates accuracy. Accuracy is the measure of the closeness of an observed value to the "true" value (theoretical or reference

value or population mean). The accuracy of an analytical method and/or the laboratory analyst, is based on the analysis of laboratory control standards. The results laboratory control standards are used to calculate the quality control parameter for accuracy evaluation, the Percent Recovery (%R).

The %R is defined as 100 times the observed concentration divided by the true concentration of the spike.

3.3.3 Data Validation

Data validation is performed to check data integrity and to verify that the data is correct and of an acceptable quality. Data integrity involves reviewing all documentation for errors and mistakes. It includes review for correct documentation of sample ID's, verification that holding times were met, transcription errors, correct calculations, complete records, and for acceptable chain of custody documentation. A review of the data is performed to verify the results and to assure that all QC is within acceptable criteria. The data is reviewed according to the criteria that applies to the particular analysis and according to the client specific project requirements. The reviewer will identify unacceptable data and initiate the appropriate corrective actions.

Data validation begins with the processing of data. Data processing can be performed by the analyst who obtained the data or by another analyst. Validation continues with checking that the data processing has been done correctly. This step can be performed by an independent analyst or the Department Supervisor. At this time a member of the QA/QC Department may review the data processing. All those who review data processing shall indicate this by signature and date on the documents validated or reviewed.

In general, data will be processed by an analyst in one of the following ways:

- Manual computation of results directly on the data sheet or on calculation pages attached to the data sheets
- Input of raw data for computer processing
- Direct acquisition and processing of raw data by a computer.

If data is manually processed by an analyst, all steps in the computation shall be provided

including equations used and the source of input parameters such as response factors, dilution factors, and calibration constants. The analyst shall sign and date in ink each page of calculations. For data that are input by an analyst and processed using a computer, a copy of the input shall be kept and uniquely identified with the sample numbers and other information as needed. The samples analyzed shall be evident and the input initialed and dated by the analyst. If data are directly acquired from instrumentation and processed, the analyst shall verify that the following are correct: sample numbers, calibration constants and response factors, output parameters such as units, and numerical values used for detection limits. The analyst shall initial and date the resulting output.

The Department Supervisor or his representative will validate the data entered into the LIMS. The data is then released to the Report Generation department for generation and preparation of a final report. Data reports must be reviewed to verify that information reported by GCAL corresponds with processed analytical results. The final report is reviewed by the Data Validation department prior to transmission of the report from the laboratory. The laboratory Data Validation Manager or his designee signs the final report. The client will be notified in writing if there were any difficulties encountered while performing the analysis.

4.0 ADMINISTRATIVE ORGANIZATION

GCAL is organized along clear lines of authority to provide our clients with service that is efficient and reliable. The organizational structure of the laboratory is shown in Appendix A. To assure communication between the departments, key personnel meet weekly, or more frequently as needed to discuss and coordinate the activities in the laboratory. The laboratory personnel also meet daily with project management to discuss key issues for that day. Resumes of key personnel are attached in Appendix A.

It is the policy of the laboratory that at each management and operational level a designated deputy or deputies will maintain continuity of service and other functions in the event of absence of key staff.

Each department within the laboratory has specific roles and responsibilities in terms of producing a product of known quality. All laboratory personnel are expected to have a working knowledge of the Quality Assurance Program Plan.

The General Manager bears the primary responsibility for data quality at the laboratory. The General Manager directs the functional areas of marketing, finance and administration for the laboratory.

The Operations Manager is responsible for coordinating the activities of analysts and technicians. The Operations Manager assures the commitment of sufficient resources for the timely generation of data of a known quality. The technical operation of the laboratory is the responsibility of the Operations Manager.

The Technical Services Manager is responsible for coordinating the activities of the sample administration department, client services, and administrative support personnel.

The Information Technology Director manages the implementation and development of information technology tools. He is also responsible for the automated data collection systems used by the laboratory. He performs strategic planning for IT projects based on projected needs of the Laboratory. Interacts with clients to determine IT requirements such as electronic deliverables.

The QA/QC Director is responsible for the preparation and maintenance of the laboratory Quality Assurance Program Plan. The QA/QC Director acts as the official laboratory contact for audits, performance evaluation studies, and project-specific quality control issues. The QA/QC Director approves and confirms the implementation of corrective actions. The QA/QC Director is responsible for the approval and distribution of controlled documents. The QA/QC Director has the authority to intercede in all areas where quality related problems exist. No work will be released until the related quality deficiency has been corrected and approval has been given to proceed forward.

Department Supervisors are responsible for the overall flow of work and data through the laboratory. They are responsible for the maintenance of accurate SOP's. Further responsibilities include general management of all activities within their department, ensuring that all instrumentation and equipment meet performance criteria and calibration requirements, and training of laboratory staff. The Supervisor is responsible for validating data released from the department. Department Supervisors inform the Operations Manager or Technical Services Manager of project status and capacity issues.

Project Managers act as liaisons between the laboratory and the client. Responsibilities include sample scheduling, communicating project-specific requirements to laboratory personnel, review of log-in summaries, notifying the client of any sample receipt or analytical problems, monitoring the progress of analytical work, and providing data to clients in a timely manner. Project Managers document client complaints.

At the bench level, analysts/chemists are responsible for the generation of data by analyzing samples according to written SOP's. They are also responsible for ensuring that all documentation related to the analysis is accurate and complete. The analyst/chemist should inform the Department Supervisor of quality problems immediately. The analysts/chemists have the authority to accept or reject data based on compliance with QC acceptance criteria. Analysts/Chemists are responsible for initial review of all data.

The Data Validation Manager is responsible for review of final reports. Any discrepancies found in the data is reported to the appropriate Department Supervisor for review and correction if necessary.

5.0 FACILITY DESCRIPTION AND CAPITAL EQUIPMENT

5.1 LABORATORY FACILITIES

GCAL is a full service environmental laboratory. The laboratory was established in 1979 with a staff of two and has grown to its present size of over 55 employees operating in a modern laboratory space of 20,000 square feet.

The laboratory's working areas are subdivided into areas for instrumental analysis, wet chemistry and sample preparation . These areas are designed to allow for a safe and comfortable working environment with special attention having been given to ventilation, air flow patterns and environmental controls. Administrative and Marketing areas are located for optimization of supervision and to allow for efficient handling of paperwork and results. The laboratory is protected by an electronic security system. A floor plan of the facility is included in this document.

5.2 CAPITAL EQUIPMENT

Laboratory equipment and instrumentation are maintained in compliance with instrumentation manuals. All equipment is kept in working condition to allow for conformity to each approved method. The key instrumentation such as Gas Chromatography, Mass Spectrometers/Gas Chromatographs, ICP and Atomic Absorption Spectrometers have maintenance contracts with their respective suppliers. A list of instrumentation and equipment is included in Appendix B.

6.0 PREVENTIVE MAINTENANCE

In order to prevent system down time, minimize corrective maintenance cost and to help insure data validity, GCAL uses a system of preventive maintenance.

Specific operator manuals are used to pinpoint steps in the preventive maintenance scheme for individual instruments. All routine maintenance is performed as recommended by the manufacturer. These manuals also assist in identification of commonly needed replacement parts so that an inventory of these parts can be properly maintained. Maintenance contracts are purchased for most instruments. This insures periodic preventive maintenance visits by factory authorized service representatives and immediate service for corrective actions if required.

An instrument log, is associated with each instrument. Notation of the date and preventive maintenance activity is recorded when performed. This includes routine service checks by laboratory personnel as well as factory service calls. Instrumentation logs are periodically reviewed by the QA manager and the information contained in them is used to help identify long and short term equipment needs of the laboratory. This log also provides a written source for future use in preventive maintenance. A preventive maintenance SOP details the frequency and type of routine maintenance required for laboratory instrumentation. Maintenance logs are also used for ovens, refrigerators, incubators, etc. The log is to ensure that every facet in the operation of this lab is correctly documented.

Calibration curves, verification standards and internal standards insure that an instrument produces acceptable results. If calibration values do not conform to the expected results, calibration is repeated. An operator may perform routine maintenance at this point if problems persist. Some examples of these tasks would be the replacement of a nebulizer, adjusting an uptake level, cleaning a mixing chamber or replacing a column. Intensive maintenance is performed by authorized representatives of the instrument manufacturer.

All balances are serviced by an external certified service engineer semi-annually. Analytical balances are calibrated daily, using Class S weights. The Class S weights are re-certified annually. Daily temperature logs are also kept for other instrumentation to insure reliable analytical data. All liquid-in-glass thermometers used for recording temperatures are calibrated against a NIST-traceable thermometer yearly. The calibration of dial-type thermometers and temperature probes are checked quarterly against a NIST-traceable

thermometer.

When a piece of equipment is deemed defective, it is taken out of service and identified with an orange "OUT OF SERVICE" label. For support equipment such as balances, ovens, coolers, and pipettors, the QA/QC Department is notified so that proper servicing and repair can be scheduled. Routine and preventive maintenance for major instrumentation is performed by the analysts. If outside service is necessary, it is scheduled by the Department Supervisor, with approval from the Operations Manager. Satisfactory instrument performance must be verified prior to returning to service any repaired equipment.

7.0 CORRECTIVE ACTION

Corrective actions are a continual part of GCAL's plan for quality assurance in sample analysis. When errors, deficiencies, or out-of-control situations develop, corrective action is taken.

Every attempt is made by the laboratory staff to comply with the requirements set forth in the methodology, Standard Operating Procedures, and the Quality Assurance Program Plan. If departures are needed due to client requests they will be reviewed by the Operations Manager and the QA/QC Director. If departures from specified requirements occur due to unforeseen circumstances , the occurrence will be documented. If samples are affected by the departure the client will be notified and a case narrative will be included with the report. Corrective action will be initiated if necessary

On-the-spot or immediate action usually applies to spontaneous, or generally non-recurring problems, such as an instrument malfunction. Long-term corrective action is used to eliminate unsatisfactory conditions in order to improve overall data quality.

On-the-spot Corrective Action Procedure: Any staff member who detects/suspects nonconformance to previously established criteria or procedure in equipment, instruments, data, methods, etc. shall immediately notify the appropriate department supervisor and/or Operations Manager. In many cases, the staff member will be able to correct the problem.

When a situation results in a change in data reported, a corrected report shall be prepared and submitted to the client. The corrected report file copy shall then be attached to the top of the original report file copy so that sample analytical data is complete and accurate.

If a large quantity of data is affected, or if any of the analyses conducted during the suspect period were of a critical nature, or if the program involved is one which requires documented corrective action, the long-term corrective action procedure is to be followed.

Long-term Corrective Action Procedure: Any staff member who detects a recurring or unresolved quality assurance problem shall advise the Operations Manager and the QA/QC Director. The QA/QC Director shall notify the Operations Manager and the Department Supervisor if applicable, and prepare and route a Corrective Action Form (CAF), and advise

GCAL management by copy of the CAF (See Miscellaneous Forms).

As determined appropriate, the staff member, Department Supervisor, Operations Manager, QA/QC Director, and GCAL management shall consult to determine a suitable corrective action plan and report same on the CAF. The corrective action shall be initiated, documented and results forwarded to QA/QC Director. The QA/QC Director shall investigate to verify resolution. The QA/QC Director shall close the CAF or plan for follow up if determined necessary before CAF may be considered closed. If the corrective action was unsuccessful, the above procedure is to be repeated.

In the event that data reported to clients has been affected/corrected, they will be contacted in writing by the QA/QC Director, informing them of the circumstances and that a corrected report will be issued to them.

Corrective action forms will also be used to document and investigate customer inquiries and complaints.

8.0 LABORATORY EVALUATION AND AUDIT

8.1 Performance Audits

As a check on the laboratory's accuracy and precision, as well as to demonstrate performance for certification, GCAL participates in several inter- and intra-laboratory check sample programs. The intra-laboratory check sample program includes the submission of blind samples (duplicates and spikes) by the QA/QC Director. These samples are analyzed as routine samples by normal procedures with no additional priority or care by the analyst. In this way, a normal laboratory analysis is completed and reviewed by the QA/QC Director to monitor the control of test procedures and analysts.

We participate in the following programs to demonstrate analytical proficiency or to provide proof of acceptable performance for certification by outside agencies.

- Water Pollution Performance Evaluation Studies
- Soil Studies

8.2 System Audits

System audits are performed to determine if all aspects of the QA program are operational.

The following elements of the program are reviewed by the QA/QC Director:

Sample handling, including custody and storage procedures
Sample analysis
Records
Preventive maintenance
Check sample programs (proficiency testing)
Training

Through use of a check list, the QA/QC Director reviews all information pertaining to QA at this time, summarizes the situation and notes any deficiencies. A report is prepared based on the audit and is distributed to management in a timely manner. The report is also discussed with laboratory personnel so that a concerted effort can be made to correct any deficiencies as well as provide positive feedback.

The QA/QC department conducts a review of 5% of all final reports. The review includes a complete audit of the raw data and the report.

8.3 Annual Management Review

The laboratory quality system will be reviewed annually by the management. The review will ensure the suitability and effectiveness of the quality system and introduce any necessary changes and improvements. The review will include at least the following:

- Matters arising from the previous review
- Review of audit reports – external and internal
- Proficiency study results and corrective actions
- Results of in-house quality checks
- Client complaints
- Staff training
- Adequacy of staff, equipment, and facility resources
- Future plans and estimates for new work and new staff

9.0 SUBCONTRACTING OF ANALYSIS

Sub-contracting laboratories will be reviewed with an emphasis on their overall quality control practices and compliance to GCAL quality assurance requirements. Any laboratory used for subcontracting must be certified or accredited if required for the project. The QA/QC Department will submit a request to lab to provide verification of certification or will notify the appropriate accrediting authority to verify certification. If testing is subcontracted to another laboratory, the client will be notified in writing.

10.0 ANALYTICAL METHODOLOGY

GCAL utilizes methods of analysis that provide evidence of analyte identification, separation from interfering substances, limits of measurement appropriate to that of analyte concentration and reasonable measures of precision and accuracy of the data obtained. Depending upon the analysis requested and the sample matrix, the methods used may be official, standard or reference, screening, or modified. Analyses will be performed in accordance with the methods cited herein unless specific project requirements or needs dictate adoption of an alternate method or modification of the cited methods.

If analysis is performed in an alternate manner, the method shall be documented. Documentation is dependent upon the specific instrumentation and data collection and reduction methods used within the lab. Methods used directly from official or standard procedures are referenced as such. Routinely used procedures are available in each department and are also available on the internet. Official protocols are used when required or requested.

The methods indicated in the following tables are typical and for information purposes only. Additional methods are available, including industrial hygiene methods.

10.1 Arrangements Ensuring Laboratory Review of New Work

For the laboratory to perform additional work within its scope or to expand its scope of testing a thorough review must be undertaken. Laboratory management considers available resources and current and pending workload prior to accepting new work.

It is the responsibility of the Laboratory Operations Manager, with input from the department supervisors and General Manager, to assess the ability of the laboratory to accept new work.

ORGANICS

PARAMETERS	METHOD	REFERENCE
Aromatic Volatile Organics	8021B	2
Benzidine	605	6
Explosives	8330	2
Phenols	604 8041	6 2
Organochlorine Pesticides	608 8081A	6 2
PCB's	8082	2
TPHG	8015BM	2
TPHD	8015BM	2
GRO	8015BM	2
DRO	8015BM	2
ORO	8015BM	2
Petroleum Range Organics	FL-PRO	10
Total Petroleum Hydrocarbons	TX1005/1006	13,14
EPH	MASS	15
VPH	MASS	16
Organophosphorus	8141A	2

Pesticides		
Chlorinated Herbicides	8151A	2

ORGANICS

PARAMETERS	METHOD	REFERENCE
Dissolved Gases	RSK175	9
GC/MS Volatile Organics	624 8260B	6 2
GC/MS Semivolatile Organics	625 8270C	6 2
GC/MS SIM	8270C	2
HPLC-PAHs	8310	2
Solvents	8000	2
Alcohols	8000	2
Methanol	94.03/99.01	11
Extractions and Preparations		
TCLP	1311	2
SPLP	1312	2
Liquid-Liquid	3510C 3520C	2 2
Ultrasonic	3550B	2

ORGANICS

PARAMETERS	METHOD	REFERENCE
Extractions and Preparations		
Waste Dilution	3580A	2
Soxhlet	3540C	2
Purge & Trap	5030B	2
Closed System Purge & Trap & Extraction for VOA in Solids and Wastes	5035	2

METALS

PARAMETERS	METHOD	REFERENCE
Aluminum		
-ICP	200.7	7
	6010B	2
Antimony		
-GFAA	204.2	1
	7041	2
-ICP	200.7	7
	6010B	2
Arsenic		
-GFAA	206.2	1
	7060A	2
-ICP	200.7	7
	6010B	2
Barium		
-ICP	200.7	7
	6010B	2
Beryllium		
-ICP	200.7	7
	6010B	2
Boron		
-ICP	200.7	7
	6010B	2
Cadmium		
-ICP	200.7	7
	6010B	2
Calcium		
-ICP	200.7	7
	6010B	2

METALS

PARAMETERS	METHOD	REFERENCE
Chromium		
-ICP	200.7	7
	6010B	2
Chromium (Hexavalent)		
-colorimetric	7196A	2
Cobalt		
-ICP	200.7	7
	6010B	2
Copper		
-ICP	200.7	7
	6010B	2
Iron		
-ICP	200.7	7
	6010B	2
Lead		
-GFAA	239.2	1
	7421	2
-ICP	200.7	7
	6010B	2
Magnesium		
-ICP	200.7	7
	6010B	2
Manganese		
-ICP	200.7	7
	6010B	2
Mercury		
-Cold vapor	245.1	1
	7470A	2
	7471A	2
Molybdenum		
-ICP	200.7	7
	6010B	2
Nickel		
-ICP	200.7	7
	6010B	2

METALS

PARAMETERS	METHOD	REFERENCE
Phosphorus	200.7	7
Potassium		
-ICP	200.7	7
	6010B	2
Selenium		
-GFAA	270.2	1
	7740	2
-ICP	200.7	7
	6010B	2
Silver		
-ICP	200.7	7
	6010B	2
Sodium		
-ICP	200.7	7
	6010B	2
Strontium	200.7	7
-ICP	6010B	2
Thallium		
-GFAA	279.2	1
	7841	2
-ICP	200.7	7
	6010B	2
Tin		
-ICP	200.7	7
	6010B	2
Titanium		
-ICP	200.7	7
	6010B	2
Vanadium		
-ICP	200.7	7
	6010B	2
Zinc		

-ICP	200.7	7
	6010B	2

METALS

PARAMETERS	**METHOD**	**REFERENCE**
Zirconium		
-ICP	200.7	7
	6010B	2
Sample Preparation Methods		
- Acid Digestion – Aqueous FLAA & ICP	200.7	7
	3010A	2
- Acid Digestion – Aqueous GFAA	200.0, 2XX.X	1
	3020A	2
- Acid Digestion – Solids	3050B	2
- Microwave Assisted Acid Digestion – Solids & Organic Matrices	3051	2
	3052	2
- TCLP	1311	2
- SPLP	1312	2

INORGANICS

PARAMETERS	METHOD	REFERENCE
Acidity	305.1/305.2	1
	2310 B	3
Alkalinity	310.1	1
	310.2	1
	2320 B	3
Ash	D482	4
BOD/BODC	405.1	1
	5210 B	3
Bromide	320.1	1
	300.0	1
	9056	2
BTU – Heat of Combustion	D240-92	4
Cation Exchange Capacity	9080	2
COD	Hach 8000/8328	5
Corrosivity	1110	2
	9040	2
	9045	2
Chloride	325.3	1
	300.0	1
	9056	2
	9251	2
Residual Chlorine	330.3	1
	4500-Cl G	3

INORGANICS

PARAMETERS	METHOD	REFERENCE
Coliform		
-Fecal	9222 D	3
Color	110.2	1
	2120 C	3
Conductivity	120.1	1
	2510 B	3
	9050A	2
Corrosivity Toward Steel	1110	2
Cyanide		
-Free	335.3	1
-Total	335.2/335.3	1
	9012A	2
-Amenable to Chlorination	335.1/335.3	1
	9012A	2
Density	2520C	3
Fluoride	340.1	1
	300.0	1
	9056	2
Hardness		
-Calculation	2340B	3
Ignitability	1010	2
	1030	2.
% Moisture	SW846	2
Nitrogen		
-Ammonia	350.2	1
	350.3	1
	4500-NH_3BF	3
	4500-NH_3BF	3

INORGANICS

PARAMETERS	METHOD	REFERENCE
Nitrogen		
-Kjeldahl	351.3	1
	4500-NH_3BE	3
	4500-NH_3BF	3
-Nitrate	353.2	1
-Nitrite	353.2	1
-Total Nitrate-Nitrite	353.2	1
Oil & Grease	1664A	8
	9070	2
	9071A	2
Oxygen, Dissolved	360.1	1
	4500-OC	3
Paint Filters Liquids Test	9095A	2
Phenolics	420.1/420.2	1
	9066	2
pH	150.1	1
	4500-H^+B	3
	9040A	2
	9045A	2
Phosphorus		
-Orthophosphate	365.2	1
	4500PBE	3
-Total Phosphorus	365.1	1
Reactivity		
-Cyanide	7.3.3.2	2
-Sulfide	7.3.4.2	2
Silica, Dissolved	370.1	1
	4500-SiD	3

INORGANICS

PARAMETERS	METHOD	REFERENCE
Solids		
-Total Dissolved	160.1	1
	2540 C	3
-Total Suspended	160.2	1
	2540 D	3
-Total Solids	160.3	1
	2540 B	3
-Total Volatile Solids	160.4	1
	2540 E	3
-Volatile Suspended Solids	2540 E	3
-Settleable	2540 F	3
Specific Gravity	2710 F	3
Sulfate	375.4	1
	300.0	1
	9038	2
	9056	2
Sulfide	376.1	1
	376.2	1
	4500-S^{-2}D	3
	9034	2
Sulfite	377.1	1
	4500-SO_3^{-2}B	3
Surfactants		
-Ionic (MBAS)	5540 C	3
-Non-Ionic (CTAS)	5540 D	3
Total Organic Carbon (TOC)	415.1	1
	5310B	3
	9060	2
Total Organic Halides (TOX)	450.1	1
	9020B	2
	5050/9056	2

INORGANICS

PARAMETERS	METHOD	REFERENCE
Turbidity	180.1 2130 B	1 3
Viscosity	D2196	4
Perchlorate	314.0	12
Sample Preparation Procedures		
- Alkaline Digestion – Cr^{+6}	3060A	2
- Bomb Prep Method for Solid Waste	5050	2
- Distillation – Sulfides	9030B	2
- SPLP	1312	2

METHOD REFERENCES

1) EPA 600 4-79-020, Methods For Chemical Analysis of Water and Wastes, 1983, second printing.

2) EPA SW-846, Test Methods for Evaluation Solid Waste, 3rd Edition, Update I dated 7/92, Update II dated 9/94, Update IIA dated 8/93, Update IIB dated 1/95, Update III dated 12/96.

3) APHA/AWWA/WPCF, Standard Methods for the Examination of Water and Wastewater, 18th Edition, 1992.

4) ASTM, American Society for Testing & Materials.

5) Hach Company, EPA Approved Procedures for Water and Wastewater, 1986.

6) 40 CFR Part 136 Appendix A, Test Procedures for Analysis of Organic Pollutants

7) Method 200.7, Determination of Metals and Trace Elements in Water and Wastes By Inductively Coupled Plasma-Atomic Emission Spectrometry, Revision 4.4, EMMC Version, May 1994.

8) EPA-821-R-98-002, USEPA Office of Water Analytical Methods; Method 1664, Revision A: N-Hexane Extractable Material (HEM; Oil and Grease) and Silica Gel Treated N-Hexane Extractable Material (SGT-HEM; Non-polar Material) by Extraction and Gravimetry, February 1999.

9) EPA Standard Operating Procedure

10) Florida Department of Environmental Protection, Method For Determination of Petroleum Range Organics, FL-PRO, Revision 1, November 1995.

11) NCASI Method DI/MEOH-94.03, Methanol in Process Liquids by GC/FID, May 2000 and NCASI Method DI/HAPS-99.01, Selected Haps in Condensates by GC/FID, February 2000.

12) NERL, Office of Research and Development, EPA; Method 314.0, Determination of Perchlorate in Drinking Water Using Ion Chromatography, Revision 1.0, November 1999.

13) TNRCC; Method 1005, Total Petroleum Hydrocarbons, Revision 03, June1,2001.

14) TNRCC, Method 1006, Characterization of Nc_6 to Nc_{35} Petroleum Hydrocarbons in Environmental Samples , Draft

15) Massachusetts Department of Environmental Protection, Method for the Determination of Extractable Hydrocarbons (EPH), Revision1

16) Massachusetts Department of Environmental Protection, Method for the Determination of Volatile Hydrocarbons (VPH)

11.0 STANDARD OPERATING PROCEDURES

GCAL employs standard procedures for all work performed. These standard procedures insure that work is completed in a professional and timely manner and that all contractual obligations are met.

The standard operating procedures cover (1) sample receipt and handling, (2) data generation, reduction and validation, and (3) sample and waste disposal.

Standard safety procedures are also part of GCAL Standard Operating Procedures. Confidentiality and security agreements on all work performed are strictly enforced.

The following procedures are used at GCAL in order to obtain dependable analytical results and to ensure compliance with regulations.

1) To protect yourself and others, the Laboratory Safety Manual must be followed completely. Each provision is to be read and understood thoroughly prior to working in the laboratory.

2) Sample integrity is a vital part of Quality Assurance. Samples being submitted should be logged in immediately. If there must be a delay, log-in should be aware of those samples requiring refrigeration, and store them accordingly until they can be logged in. Any sample that is suspected of being contaminated, improperly stored or preserved, or improperly prepared, should be reported to the group leader immediately. No sample is to be analyzed if there is a question as to its integrity.

3) Always return a sample to its place of origin after use. This not only aids in the preservation of sample integrity, but also in better sample tracking.

4) No sample, reagent or standard is to be left open unattended. If a samples preparation must be interrupted, the contents of the containers will be properly covered to prevent contamination and evaporation.

5) Sample homogeneity is very important in the analysis of all parameters. Liquid samples are to be shaken sufficiently. Soil samples are to be combined efficiently prior to analysis.

6) New standards and reagents are to be maintained according to procedural guidelines for each parameter. These standards are to be labeled with the date of preparation and properly stored. Pre-prepared standards and reagents are labeled with the date of receipt and properly stored. Before an analysis is performed the standards and reagents used should be checked for quality.

7) Only primary standard reagents are to be used in the preparation of laboratory

standards. The standard is to be prepared according to the method specifications including appropriate drying times.

8) Calibration requirements are to be followed for all methods. If the standard does not authenticate the initial calibration curve, a new calibration curve is necessary.

9) Each group of samples being analyzed will be accompanied by a reagent or method blank (MB). These blanks are only valid if carried through the exact chemical processes involved in analyzing the samples and quality control data. Failure to include blanks will cause data from that particular set of samples to be invalid. If a set of data is determined invalid, it must be re-analyzed.

10) Each analyst is responsible for his/her own tests. This means that they must first read and understand the official procedures. The analyst must also prove that he is able to perform the test with the precision and accuracy required. It is the duty of the group leader to work with each analyst to improve their understanding of the analysis and their ability to produce precise and accurate data. All methods used must be approved and accepted by this laboratory. Modifications on any method must be reported to the QA/QC Department to determine the reliability and accuracy of the modification.

11) All quality control data is to be calculated at the time of analysis. The appropriate corrective action must be taken for failures.

12) Quality Control data for inorganic parameters is maintained on a 5% minimum basis for all parameters analyzed in a given day.

13) Quality Control data for organic analysis is maintained daily to give a 5% minimum daily average.

14) A record of all analyses is maintained. Preparation log sheets are stored in binders in sequential order. All raw data is filed for future reference.

15) All logbook entries are labeled, dated and signed.

16) It is the responsibility of the analyst who operates a particular instrument to perform all required maintenance according to the schedule defined in the instrument manual. A record of the date and activity performed during preventive maintenance, daily services and service representative visits must be maintained.

17) Temperature and calibration checks are to be performed daily. All refrigerators, water baths and ovens are to be checked by the analyst using them. If there are any changes made to regulate the temperature it is to be noted on the temperature

record.

18) At the completion of a project, the Department Supervisor reviews the data obtained. If it is determined that the results meet the previously described criteria for acceptance of the data, the Department Supervisor validates the data in the LIMS.This is documented electronically by the initials of the validtor and the date.

11.1 Sample Custody and Integrity

GCAL utilizes a Laboratory Information Management System (LIMS) that was specifically developed for the needs of environmental laboratories. Horizon, developed by Chemware, Inc. tracks samples and data throughout the laboratory. Results are available from the LIMS in a variety of hard copy formats. Furthermore, web access can be provided to clients who wish to view their data via the world wide web. A password security system prevents a client from viewing any data other than their own.

The following is an example of some of the information that is entered into the system:

1. Sample number (unique to this sample)
2. Job number (unique to this job or set of samples)
3. Date received
4. Time received
5. Date analytical results due
6. Sample description
7. Customer's name
8. Customer's address
9. Group number
10. Storage location
11. Notation of any special handling instructions or priority assignments
12. Billing information - purchase orders
13. Analyses requested

The Sample Administration Department also maintains an electronic log of all samples received. The log includes basic information concerning the samples including; date of receipt, client, matrix and tests assigned. The information is stored with the final report.

GCAL understands that sample integrity is a vital part of Quality Assurance. Samples submitted to the laboratory should be logged in immediately. If there must be a delay in this process, log-in should be aware of those samples requiring refrigeration and store them accordingly. Any sample that is suspected of being contaminated, improperly stored or preserved, or improperly prepared, should be reported to the client immediately. Storage blanks located in the volatiles refrigerators are analyzed every two weeks. Records of these analyses are maintained in the GC and GC/MS Volatiles laboratories. No sample is analyzed if there is a question concerning its integrity.

After the sample analyses are complete and the final report is issued to the client, samples are held for 60 days from receipt before disposal. Samples may be held longer per the customer request. All customers are encouraged to take possession of their remaining sample after analysis.

11.2 Chain of Custody

A complete chain of custody is maintained by GCAL. Each sample when submitted to our laboratory is accompanied by a Chain of Custody form (Figure 3). These forms contain pertinent information about the sample including specific analytical requests, sampling notes, sample condition, customer name and address.

Additionally, information concerning the site name, field identification marks, date and time of collection, sampler signature, and preservation data is recorded.

Samples are tagged, preserved if necessary and stored appropriately (i.e. refrigerator, freezer or shelf). Samples to be analyzed for volatile organic compounds are stored in refrigerators located in the volatiles analytical laboratories.

11.3 Custody Transfer

If a sample requires additional work to be performed by a qualified outside laboratory, a chain of custody form is completed and submitted with a representative portion of the sample. A copy of this form is maintained on file along with similar information located in a logbook. The chosen laboratory must sign and date the form upon receipt and return it, along with any unused sample, upon completion of analysis.

11.4 Sample Kits

Occasionally, a customer will request a sampling kit (bottles, vials, etc.) with which to collect samples. Chain of Custody forms are always sent along with the kit to insure proper sample

custody. This form is completed at the time of sample collection and is returned with the samples.

11.5 Shipping Requirements

The Department of Transportation (DOT) regulations shall be used for packaging and quantities of shipment. Shipping containers shall be secured using impact strapping material. Copies of the signed Chain of Custody (COC) forms must be delivered with the containers. Any samples being split with another party must be properly labeled, contain a COC, and be packed and shipped according to DOT regulations.

A laboratory file is maintained listing sample kits prepared for clients. It contains the client name, address, form of delivery, preservative (if requested), sample bottle distribution, and analyses to be performed. Additionally, the date the kit is requested, sent and expected arrival date is included, along with any pertinent miscellaneous information.

11.6 Cleaning Procedures

The method of cleaning is determined by the substances to be cleaned and the analysis to be performed. All bottles are purchased pre-cleaned. Accepted disposable glassware is also utilized to prevent contamination.

Water soluble substances can be washed with hot water and the vessel finally rinsed with small amounts of deionized water. Other substances may require the use of a detergent, organic solvent, chromic acid cleaning solution, nitric acid or aqua regia.

For trace metal analysis, the glassware shall be soaked in a 1:1 nitric acid bath. Rinse thoroughly with successive portions of deionized water. Chromic acid should not be used for cleaning of glassware for trace metal analysis or BOD bottles.

Glassware used for phosphate determinations should be thoroughly rinsed with tap water and then deionized water. Detergents containing phosphates should not be used for cleaning this glassware.

For ammonia and Kjeldahl nitrogen determinations, the glassware must be rinsed with ammonia-free water.

Glassware should be cleaned in the following manner:

- Wash with detergent and water
- Rinse three times with warm tap water
- Rinse three times with deionized water

- Rinse three times with acetone (reagent grade or better). (For organic glassware)
- The preceding procedure is programmed into the laboratory dishwasher which is used for most glassware. The acetone rinse step is replaced with a high heat drying step.
- Glassware used for metals analysis is soaked in an acid bath a minimum of 4 hours and then rinsed with deionized water.
- Periodically glassware may be soaked in a chromic acid cleaning solution. (Except for metals glassware and BOD bottles)
- Prior to sample preparation or analysis, the glassware is rinsed one time with the solvent to be used in the method.

11.7 Data Generation and Reduction

Initial data reduction is the responsibility of the analyst who performs the analysis and/or operates an instrument.

Each analyst records all manually generated data in a logbook associated with the analysis or type of analysis being performed. The spike recoveries and precision for duplicates are calculated and recorded in the logbook. The analyst verifies that all sample identifications are accurate.

Data reduction includes all activities that convert instrument/computer responses into reportable results. This may involve calculations, compound identification, and QC sample calculations. Final results are obtained by direct reading from the instrument or calculations based on instrument readings, output, or responses. Manual data reduction is performed by calculating results with the appropriate formula. Manually entered information such as the sample ID is reviewed for accuracy on the hard copy. Computer data reduction requires that the analyst verify information used in final calculations is entered accurately. The analyst must also review the raw data for properly identified components, possible interferences, confirmation requirements, and acceptable readings for multiple integrations.

Instrumentation run logs generated by the Target software for organic analysis are placed in a three ring binder that serves as the logbook for the applicable instruments. The run log identifies the file number for retrieving hard copy or electronic data. Bench sheets and/or hard copy printouts of run sequences are maintained for Inorganic data. The hard copy is retrievable based on the analytical date and time. All raw data is maintained in files by the individual departments.

All associated quality control samples are documented or referenced on the run log or sequence along with the sample analytical data or a file number which represents the appropriate hard copy or electronic data. The recoveries are documented on the raw data or in the logbook as appropriate.

Data verification is performed to check data integrity and to verify that the data is correct and of an acceptable quality. Data integrity involves reviewing all documentation for errors and mistakes. It includes review for correct documentation of sample ID's, verification that holding times were met, transcription errors, correct calculations, complete records and for acceptable chain of custody documentation. A review of the data is performed to verify the results and to assure that all QC is within acceptable criteria. The Data is reviewed according to the criteria which applies to the particular analysis and according to the client specific project requirements. The reviewer will identify unacceptable data and initiate the appropriate corrective actions. The Department Supervisor or his representative will review the data entered into the LIMS. Validated data is released to the Report Generation Department. Hard copies of the final reports are reviewed by the Data Validation Department.

12.0 SAMPLE HANDLING GUIDELINES

Inorganic and Conventional Parameters

Parameters	Method*	Container	Recommended Quantity (mL)	Preservative	Holding Time
Acidity	305.1, 2310B	P,G	100	4^0C	14 days
Alkalinity	310.1, 310.2, 2320B	P,G	100	4^0C	14 days
Ammonia-N	4500NH3BE, 350.3	P,G	500	4^0C, H_2SO_4 to pH <2	28 days
Biochemical Oxygen Demand (BOD)	405.1, 5210B	P,G	1000	4^0C	48 hours
Bromide	300.0, 9056	P,G	200	None	28 days
Chemical Oxygen Demand (COD)	HACH 8000	P,G	100	4^0C H_2SO_4 to pH <2	28 days
Chloride	325.3, 9251, 9056	P,G	200	None	28 days
Chlorine, Residual	330.3, 4500 CLG	P,G	200	None	Immediately
Coliform, Fecal	9222D	P,G (sterile)	100	4^0C, $Na_2S_2O_3$	6 hours
Color	2120C, 110.3	P,G	100	4^0C	48 hours
Cyanide	335.1, 335.2, 335.3 9012A	P,G	1000	4^0C, ascorbic acid, NaOH to pH > 12	14 days
Ferrous Iron	3500FED	P,G	100	2mHCl/100mL	Immediately
Flashpoint	1010	P,G	100	None	Not specified
Fluoride	300.0, 9056, 340.2	P	500	None	28 days
Hardness	130.2 2340B	P,G	100	HNO_3 to pH < 2	6 months
Nitrogen, Kjeldahl (TKN)	4500NH, 351.4	P,G	500	4^0C, H_2SO_4 to pH < 2	28 days
Nitrate-N	353.2	P,G	100	4^0C	48 hours
Nitrite-N	353.2	P,G	100	4^0C	48 hours
Nitrate-Nitrite as N	353.2	P,G	200	4^0C, H_2SO_4 to pH < 2	28 days
Oil and Grease	1664A	G	1000	4^0C, H_2SO_4 or HCl to pH < 2	28 days
Phenols	420.1, 420.2, 9066	P,G	1000	4^0C, H_2SO_4 to pH < 2	28 days
Phosphorus, Total	365.1	P,G	200	4^0C, H_2SO_4 to pH < 2	28 days
Phosphorus, Ortho	365.2, 4500PE	P,G	200	4^0C	48 hours
pH	150.1, 9040B, 9045C	P,G	100	None	Immediately
Radiochemisrty					
Alpha, Beta, Radium	900 & 9000 series	P,G	2000	HNO_3 to pH < 2	6 months
Tritium		P,G	100	None	6 months
Radon, I-131		P,G	1000	HNO_3 to pH < 2	14 days
Reactivity	SW846 7.3.3.2, 7.3.4.2	G	100g	4^0C	Not Specified
Silica	370.1, 4500Si D	P, PFTE, Quartz	100	4^0C	28 days
Solids, Dissolved (TDS)	160.1, 2540C	P,G	100	4^0C	7 days
Solids, Suspended (TSS)	160.2, 2540D	P,G	500	4^0C	7 days
Solids, Volatile (TVS)	160.4, 2540E	P,G	100	4^0C	7 days
Solids, Total (TS)	160.3, 2.540B	P,G	100	4^0C	7 days

Inorganic and Conventional Parameters

Parameters	Method*	Container	Recommended Quantity (mL)#	Preservative#	Holding Time**
Specific Conductance	120.1, 9050	P,G	100	4^0C	28 days
Specific Gravity	2710F	P,G	100	4^0C	28 days
Sulfate	375.4, 9056, 9038	P,G	200	4^0C	28 days
Sulfide	376.1, 376.2, 9034	P,G	500	4^0C, Zn acetate, NaOH to pH > 9	7 days
Sulfite	4500S03B	P,G	200	None	Immediately
Surfactants (MBAS)	425.1, 5540C	P,G	250	4^0C	48 hours
Total Organic Carbon (TOC)	415.1, 9060	P,G	100	4^0C, HCl to pH < 2	28 days
Total Organic Halogens (TOX)	9020B	G-TLC (amber)	100	4^0C, H_2SO_4 to pH <2	28 days
Total Petroleum Hydrocarbon (TPH)	418.1	G-TLC	1000	4^0C, H_2SO_4 or HCl to pH < 2	28 days
Turbidity	180.1, 2130B	P,G	100	4^0C	48 hours
Viscosity	D2196	P,G	500	None	Not Specified

*The methods listed are from typical EPA references.
#Solid and waste samples: Quantity 1-100g, preservative 4°C.
**Holding time for solids and samples is not defined
Organic Nitrogen = TKN – Ammonia-N

Metals

Parameters	Method*	Container	Recommended Quantity (mL)	Preservative	Holding Time
Metals (except Hexavalent Chromium and Mercury):					
Aqueous					
Total	6010B, 200.0, 7000 series	P,G	500	HNO_3 to pH < 2	6 months
Dissolved	6010B, 200.0, 7000 series	P,G	500	Filter on site HNO_3 to pH < 2	6 months
Solid					
Total	6010B, 200.0, 7000 series	P,G	100g	4^0C	6 months
Hexavalent Chromium:					
Aqueous	7196A	P,G	500	4^0C	24 hours
Solid	3060A/7196A	P,G	100g	4^0C	30/7 days
Mercury:					
Aqueous					
Total	245.2/7470	P,G	500	HNO_3 to pH < 2	28 days
Dissolved	245.2/7470	P,G	500	Filter on site HNO_3 to pH < 2	28 days
Solid					
Total	7471	P,G	100g	4^0C	28 days

Metals – Boron must be collected in a polyethylene container.
*The methods listed are from typical EPA references.
CrIII=Total Cr-Hexavalent Cr

Organic Parameters

Volatile Organics

Sample Matrix	Method*	Container	Minimum Quantity	Preservative	Holding Time
Concentrated Waste Samples	8021B, 8260B, 8015M	G-TLC or G-TLS	2 x 40mL vials or 2-oz wide mouth	4^0C	14 days
Aqueous Samples	8021B, 8260B, 8015M, 624, VPH	G-TLS	2 x 40mL vials	4^0C, HCl to pH < 2, $Na_2S_2O_3$ if residual chlorine present	14 days, 7 days if not acid preserved
Solid Samples	8021B,8260B, 8015M, VPH	G-TLS or G-TLC	2-oz wide mouth and/or 3 Encores	4^0C	14 days **

*The methods listed are from typical EPA references.

**Solid samples collected in EnCore™ samplers must be transferred to a soil sample vial within 48 hours.

Semivolatile Organics, Pesticides/PCBs, Herbicides, PAHs, Petroleum Hydrocarbons

Sample Matrix	Method*	Container	Minimum Quantity	Preservative	Holding Time
Concentrated Waste Sample	8270C, 8081, 8082, 8015M, 8151A, 8141A, FL-PRO	G-TLC (Amber)	1 Liter	None	14 days until extraction, 40 days after extraction
Aqueous Samples	8270C, 8081, 8082, 8015M, 8151A, 8141A, 8310,608, 625, FL-PRO,EPH ***	G-TLC (Amber)	2 x 1 Liter	4^0C	7 days until extraction, 40 days after extraction
Solid Samples	8270C, 8081, 8082, 8015M, 8151A, 8141A, 8310,EPH FL-PRO ***	G-TLC	8 oz.	4^0C	14 days until extraction, 40 days after extraction

Parameter	Method*	Container	Recommended Quantity	Preservative	Holding Time
Dioxins and Furans**	613, 8280A, 8290, 1613	G-TLC(Amber)	2 x 1 Liter	4^0C	30 days until extraction, 45 days after extraction

*The methods listed are from typical EPA references.

**Concentrated wastes and soil samples are collected in 2 oz. to 1 Liter amber glass jars with TLC.

***1005/1006, Petroleum Hydrocarbons –14 days after extraction

TCLP/SPLP Parameters

Parameters	Holding Time from Collection to TCLP Extraction (days)	Holding Time from TCLP Extraction to Preparative Extraction (days)	Holding Time from TCLP/Preparative Extraction to Analysis (days)	Total Time
Volatiles	14	NA	14	28
Semivolatiles	14	7	40	61
Mercury	28	NA	28	56
Metals	180	NA	180	360

Reference: 40CFR Part 136 Tables IA, IB, IC, ID & IE and Table II., SW846 Table 4-1 and Table 3-1, SW846 Method 1311 8.5,

*The methods listed are from typical EPA references

Acronym Definitions: (Teflon is a registered trademark of E.I. DuPont)

CLP: EPA Contract Laboratory Program G-TLC: Glass with Teflon®-lined cap NA: Not Applicable G: Glass G-TLS: Glass with Teflon®-lined septrum P: Polyethylene

13.0 WASTE MANAGEMENT

13.1 Waste Collection and Storage

Samples are stored in the appropriate cooler for 60 days after receipt. After 60 days, samples are moved to a waste area. The samples are scanned out for disposal on the LIMS. The samples are then stored in the waste staging area until disposal into appropriate drums. Hazardous samples are returned to the client whenever possible to be disposed of with larger quantities of the sample material. Laboratory waste is segregated by laboratory personnel into waste streams which have been established by the Regulatory Compliance Officer. The waste streams are determined by analysis of the waste and through process knowledge. All laboratory wastes are disposed of in the proper container. No waste is placed in regular trash containers or poured down the drain. Waste is stored in drums in satellite accumulation areas and then in the central accumulation facility. Waste disposal service is provided by approved vendors who will incinerate, landfill, treat, or reclaim the waste based on the characteristics.

13.2 Pollution Prevention

Environmental concerns, risks to employees and the public, and high disposal costs have increased the need and effort of the laboratory to minimize or prevent waste generation. The quantity of chemicals and standards purchased is based on expected usage during its shelf-life and the disposal cost of the unused material. The volume of standards and reagents prepared in the laboratory reflect stability and anticipated usage. If possible, methods requiring the use of hazardous chemicals or that produce hazardous waste are replaced with an alternative method. Sample containers are selected based on the minimum volume that is necessary to perform a test, therefore reducing sample waste. Sample sizes are reduced in some cases, therefore reducing the quantities of extraction solvents and reagents.

14.0 SAFETY PROCEDURES

GCAL has a comprehensive safety program outlined for all employees. A safety manual is distributed to each employee followed by a training seminar to familiarize the employee with the safety procedures at GCAL.

14.1 Basic Safety Rules

1. All injuries are promptly reported to a supervisor.
2. All hazards are promptly reported to a supervisor.
3. Running and horseplay are not permitted in the laboratory.
4. Smoking is not permitted in the laboratory.
5. Laboratory glassware is not to be used for eating or drinking.
6. Laboratory reagents such as sucrose or sodium chloride should not be used for food.
7. Eating on the premises is confined to designated areas.

14.2 Arrangement of Furniture And Equipment

Furniture is arranged for maximum use of available space while providing working conditions that are efficient and safe.

Aisles are kept at least 4 feet wide to provide for safe passage of personnel and equipment, and are kept free of obstructions.

Stepladders or footstools are supplied for reaching high objects and are kept out of the way when not in use.

Eyewash stations, safety showers and fire extinguishers are located centrally and care is taken to avoid blocking access to them.

14.3 Hoods And Ventilation

Adequate hood facilities are installed and used where toxic or flammable materials are used. Hood windows provide physical protection and greater control of fumes.

14.4 Spills

Spilled materials are cleaned up promptly. All spills should be handled as if corrosive or dangerous unless definitely known to be harmless. Spill Kits are located in the laboratory.

Corrosive or toxic materials are not placed in waste cans in the laboratory. When in doubt a supervisor is consulted.

Broken glass is swept up immediately and discarded so as to avoid any injury or cuts.

14.5 Emergency Equipment

Fire extinguishers are located in each room of the laboratory. The paths to these are kept free and clear at all times.

An extinguisher which has been used shall not be returned to its holder until it has been recharged and checked.

Any fire that appears to be too large to extinguish immediately is reported to the fire department at once. All fires, regardless of size are to be reported to a supervisor. Causes shall be determined and necessary steps to prevent a similar accident shall be taken.

Eye washes are located in the laboratories for irrigation of the eyes if corrosive liquids should be splashed into them. Tubing attached to faucets in the sink may also be used to wash the eyes if necessary.

A safety shower is centrally located in the laboratories and is be used whenever corrosive materials are spilled on an analysts' skin or clothing.

All safety equipment is periodically checked to be sure everything is in working order and is easily accessible.

General first aid kits are located throughout the laboratory. These kits contain first aid products for the treatment of minor cuts and bruises, burns or abrasions,and personal discomfort.

14.6 Protective Equipment

Lab coats and aprons are supplied for all employees of GCAL. Protective clothing is always available to prevent damage to clothing and persons.

Shoes must be worn at all times and must be closed-toe, high heels or sandals are not acceptable.

Eye Protection is mandatory for all personnel working in the laboratory. Safety glasses or goggles should be worn by analysts to protect the full eye area.

Various types of gloves are provided for employees: Insulated gloves are provided for use when handling hot or cold items; Heavy rubber gloves are to be used when handling corrosive liquids or unknown substances; Lightweight disposable gloves are provided for use with toxic or irritating substances.

Air purifying respirators are available for use when working with organic vapors and/or acid fumes. These respirators should be worn whenever contact with irritating concentrations of these fumes are encountered.

Coverall suits made of chemically resistant material are provided for wear whenever sampling at a hazardous waste site or in potentially dangerous or unknown situations. These suits are disposable and provide protection for clothing and personnel.

14.7 Storage of Laboratory Materials

All chemicals, reagents and glassware are stored in such a manner that they are easily located and do not present a danger. Heavy items are kept near the floor.

Flammable solvents are stored in special cabinets or in solvent bunker. Only quantities required for immediate use are stored in analytical areas.

Reagents are grouped to prevent danger from hazardous combinations. Acids and bases are stored separately.

Compressed gases are stored away from heat and open flames. They are always contained by chains or belts to prevent rolling or toppling. A special cart is used to transport replacement cylinders and empties.

14.8 Chemical And Sample Handling

If there are questions about proper chemical handling the MSDS (Material Safety Data Sheet) is used as reference.

Samples are always treated as if they were hazardous chemicals.
Rubber pipet bulbs are used.
Procedures which produce flames or toxic vapors are performed under a hood.
Chemicals are returned to their proper storage area after use.
All prepared solutions are properly labeled.
Acids are always poured into water when diluting.
Large amounts of alkali are never added to water at one time.
Glass-stoppered containers are not used for storing alkaline solutions.
Labels for Acid and Caustic solutions will note the concentrations.

14.9 Labeling

All sample and chemical solutions are clearly labeled with chemical name and concentration or sample number. Label should note any danger associated with the solution, date of preparation, laboratory assigned ID, initials of analyst, and expiration date.

15.0 CONFIDENTIALITY

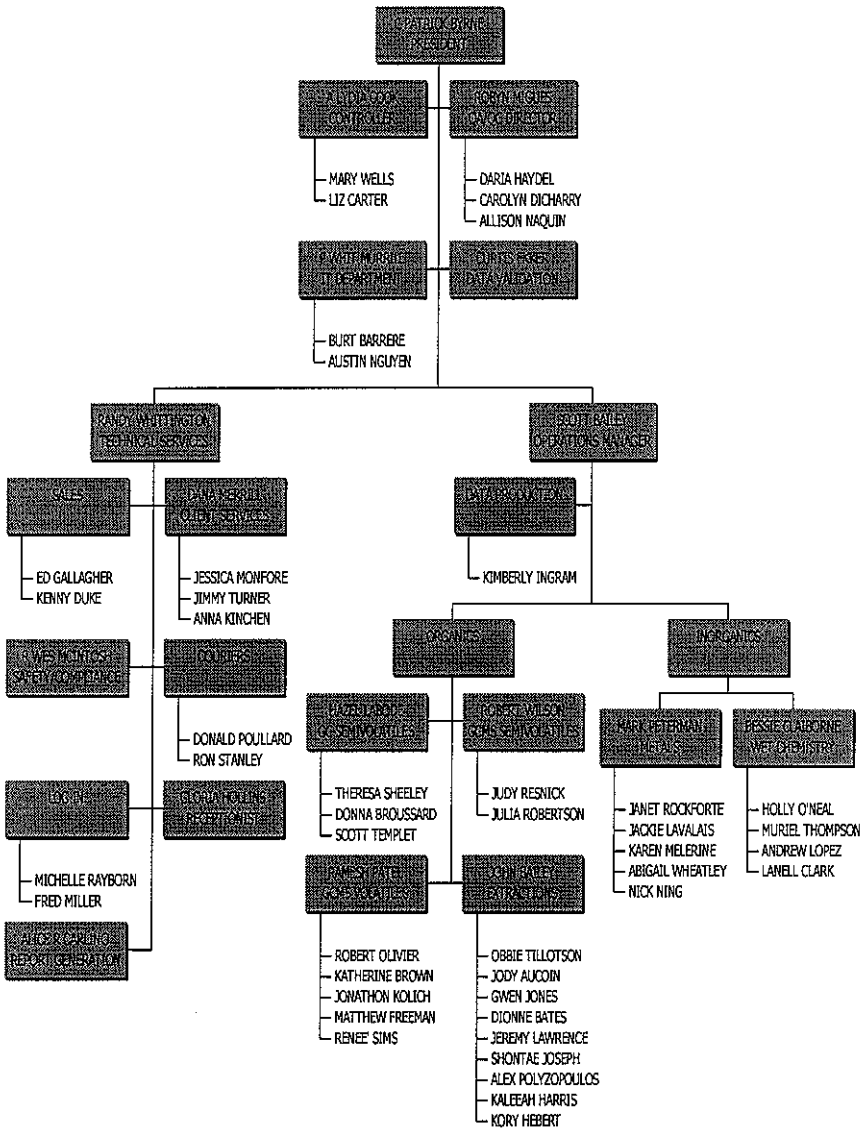
GCAL understands that it must retain in confidence all information obtained through the analysis of samples or the information disclosed to GCAL in order to adequately perform and interpret analyses.

GCAL will maintain the secrecy and confidentiality of any proprietary information it receives or generates.

Only the party who requested the analytical work or consultation, and who will receive the final report (and invoice) will be informed of any findings.

Results of analyses will not be disclosed to anyone other than the contracting party without unequivocal authorization by the contracting party.

APPENDIX A


PATRICK CRAIG
PRESIDENT
LINDA COOK
CONTROLLER
JORAN HUGUES
QA/QC DIRECTOR
MARY WELLS
LIZ CARTER
DARIA HAYDEL
CAROLYN DICHARRY
ALLISON NAQUIN
CYNTHIA PRATT
IT DEPARTMENT
CURTIS FAVRET
DATA VALIDATION
BURT BARRERE
AUSTIN NGUYEN
RANDY WHITTINGTON
TECHNICAL SERVICES
SCOTT BAILEY
OPERATIONS MANAGER
SALES
DANA VERRET
CLIENT SERVICES
DATA ACQUISITION
ED GALLAGHER
KENNY DUKE
JESSICA MONFORE
JIMMY TURNER
ANNA KINCHEN
KIMBERLY INGRAM
CHRIS MONTCRIEF
SAFETY/COMPLIANCE
COURIER
ORGANICS
INORGANICS
DONALD POULLARD
RON STANLEY
FIZZY BOY
GC SEMIVOLATILES
FOREST WILSON
GC/MS SEMIVOLATILES
MARK PETERMAN
METALS
BESSIE CLAIBORNE
WET CHEMISTRY
THERESA SHEELEY
DONNA BROUSSARD
SCOTT TEMPLET
JUDY RESNICK
JULIA ROBERTSON
JANET ROCKFORTE
JACKIE LAVALAIS
KAREN MELERINE
ABIGAIL WHEATLEY
NICK NING
HOLLY O'NEAL
MURIEL THOMPSON
ANDREW LOPEZ
LANELL CLARK
LOG IN
GLORIA HOLLINS
RECEPTIONIST
MICHELLE RAYBORN
FRED MILLER
AMY CARTER
REPORT GENERATION
JAMES PATE
GC/MS VOLATILES
JOHN VALLEY
EXTRACTIONS
ROBERT OLIVIER
KATHERINE BROWN
JONATHON KOLICH
MATTHEW FREEMAN
RENEE SIMS
OBBIE TILLOTSON
JODY AUCOIN
GWEN JONES
DIONNE BATES
JEREMY LAWRENCE
SHONTAE JOSEPH
ALEX POLYZOPOULOS
KALEEAH HARRIS
KORY HEBERT

CHARLES P. BYRNE

President and General Manager, GCAL, Inc., Baton Rouge, LA, January 1997 - present.

Responsible for all operations within the facility including laboratory, administrative, financial and marketing functions. Responsible for long range planning and structuring of future business operations.

Previous Experience:

Vice-President and General Manager, ITS-Environmental Laboratories, Baton Rouge, LA, September 1993 - January 1997.

Corporate officer in charge of all operations within the facility including laboratory, administrative, financial and marketing functions. Responsible for long range planning and structuring of future business operations.

Laboratory Manager, West-Paine Laboratories, Inc. Baton Rouge, LA, June 1992 - September 1993.

Responsible for the profit and loss of the Baton Rouge facility. Directly supervise all operations of the laboratory including staffing, budgeting and production.

Organic Manager, West-Paine Laboratories, Inc., Baton Rouge, LA., August 1991 - June 1992.

Responsible for supervision of analysts functioning in the areas of Sample Extraction, Residue Analysis via GC, Purgeables and Extractables via GC-MS. Troubleshoots and interfaces with GC-MS System Management, consisting of five HP GC-MS with RTE-6-VM and RTE-A Operating Systems. Performs method development and reviews data. Previous positions included GC/MS manager and GC manager.

Previous Experience:

GC/MS Analyst, ETC/Toxicon, Baton Rouge, LA., August 1989 - June 1991.

Operator of two Finnigan MAT 4510B Gas Chromatography/Mass Spectrometry Systems conducting the analysis of volatile organic compounds using USEPA Contract Laboratory Program (CLP)

methodology, including data reduction and report production using QA

Formaster software. Operation of HP 5890 Gas Chromatograph (ECD, FID), performing the analysis of chlorinated pesticides and PCB's using CLP methodology. The analysis of raw data and the production of data packages using QA Formaster software.

Education: BS Microbiology, Louisiana State University, Baton Rouge, LA, 1990.

Member ACS

ITS Managerial Training Skills Workshop - 1993, 1994

Cornell ITS Executive Development Program - 1994, 1995

Government Institutes Inc., RCRA Regulations, Air Toxics - 1993, 1994

Introduction to Mass Spectrometry, Basic Mass Spectrometry Interpretation - 1991

ITS - Environmental Laboratories, Baton Rouge, Manager and Supervisor Training Retreat - June 1996

Louisiana State University Fire and Emergency Training Institute- HazMat Technician Refresher - 8 Hr. - June 17, 1998

Bank One Managing and Financing Independent Business - 16 Hours - October 1998

SCOTT A. BAILEY

Current Position:

Operations Manager, GCAL Inc., Baton Rouge, LA January 1997 - Present

Responsible for coordinating the overall activities of the analytical laboratories on a daily basis and providing long-term direction. Responsibilities include monitoring the scheduling of analytical testing and releasing testing data and results.

Previous Experience:

Operations Manager, ITS-Environmental Laboratories, Baton Rouge, LA September 1995 - January 1997

Responsible for coordinating the overall activities of the analytical laboratories on a daily basis and providing long-term direction. Responsibilities include monitoring the scheduling of analytical testing and releasing testing data and results.

Organics Manager, ITS – Environmental Laboratories, Baton Rouge, LA, October1993 - September 1995

Responsible for the management of the GC, GCMS, and the extraction departments of the laboratory. Duties also included supervision of the report generation department.

Division Manager, National Environmental Testing, Baton Rouge,LA March 1992 - October 1993

Directed the functional areas of marketing, finance, chemistry, and administration for the Baton Rouge facility. Additional duties included contract administration, schcduling, and client consultation.

Operation Manager, Environmental Testing & Certification Corporation, Baton Rouge, LA , December 1989 - January 1992

Directed the functional areas of marketing, finance, chemistry, and administration for the Baton Rouge facility. Additional duties included contract administration, scheduling, and client consultation.

Previous Experience: **Analyst, ETC, Baton Rouge, LA, December 1983 - December 1989**

Education: BS, Environmental Health, Louisiana State University, Baton Rouge, LA, December 1991

ITS Managerial Training Skills Workshop, 1994

ITS - Environmental Laboratories, Baton Rouge, Manager and Supervisor Training Retreat - June 1996

UCLA ITS Executive Development Program - August

ROBYN B. MIGUES

Current Position:

QA/QC Manager, GCAL Inc., Baton Rouge, LA, January 1997 - Present

Responsible for implementing and monitoring the laboratory Quality Assurance Program Plan, conducting internal audits, reviewing reports, investigating problem areas, control-chart generation, establishing data-quality criteria, verifying corrective actions are being taken when necessary, and monitoring performance evaluation studies. Additional duties include providing reports concerning QA matters to management.

Previous Experience:

QA/QC Manager, ITS- Environmental Laboratories, Baton Rouge, LA October 1994 - January 1997

Responsible for implementing and monitoring the laboratory Quality Assurance Program Plan, conducting internal audits, reviewing reports, investigating problem areas, control-chart generation, establishing data-quality criteria, verifying corrective actions are being taken when necessary, and monitoring performance evaluation studies. Additional duties include providing reports concerning QA matters to management.

General Chemistry Supervisor, ITS- Environmental Laboratories, Baton Rouge, LA, June 1994 - October 1994

Responsibility includes the management and training of personnel conducting inorganic analysis using EPA methodologies. Duties include data validation, QC review, instrument maintenance and method set up.

Metals Supervisor, ITS –Environmental Laboratories, Baton Rouge, LA, October 1993 - June 1994

Responsible for the management and supervision of the Metals section which includes supervision of metals sample preparation, supervision and training of analysts, scheduling sample workload, analysis of samples by various analytical instrumentation and reviewing and validating all data.

Research Associate, Louisiana State University, Agronomy Department, Baton Rouge, LA, September 1990 - March 1993

Prepared and analyzed samples by ICP, maintained ICP and other laboratory

equipment, assisted associate Professor of soil and environmental chemistry with laboratory courses and research projects and supervised student workers. Computer experience includes Quattro

Previous Experience:

Spectroscopy and Water Departments Supervisor, James Laboratories,Lafayette, LA, February 1987 - September 1990
Laboratory Technician

Prepared and analyzed samples by ICP, Flame Atomic Absorption & Emission, Mercury Hydride System and Graphite Furnace. Performed quality control coordination, trained laboratory technicians, maintained equipment . Prepared and analyzed various sample types.

Education:

BS Geology, University of Southwestern Louisiana, Lafayette, LA, May 1985.

Member - American Society for Quality Control

Perkin Elmer Spectroscopy training course - 1987

Basic Statistics - Pittsburgh Conference Continuing Education Program - March 1995

Quality Management/Quality Assurance in Industry and in the Laboratory - ACS Short Course - March 1995

ITS Managerial Training Skills Workshop - 1994

ITS- Environmental Laboratories, Baton Rouge, Manager and Supervisor Training Retreat - June 1996

Executrain Microsoft Excel 5.0 Beginning For Windows - July, 1996

ERTCO - Thermometer Calibration per ISO - October 1997

Assuring Ethical Practices in The Environmental Laboratory, A Training Short Course – Analytical Excellence – October 27, 2000

Member - LADEQ Laboratory Accreditation Task Force

RANDY K. WHITTINGTON

Current Position:

Technical Services Manager, GCAL Inc., Baton Rouge, LA, January 1997 - Present

Responsible for the management and supervision of Sample Management, Project Management, and Report Generation. Duties include implementing systems for increased productivity in all three sections. Also coordinates communication among these departments and other areas of the laboratory and marketing.

Previous Experience:

Technical Services Manager, ITS-Environmental Laboratories, Baton Rouge, LA, October 1996 - January 1997

Responsible for the management and supervision of Sample Management, Client Services, and Report Generation. Duties include implementing systems for increased productivity in all three sections. Also coordinates communication among these departments and other areas of the laboratory and marketing.

Project Manager and Data Validation Manager, Terra Consulting Group, Baton Rouge, LA, 1993 - 1996

Performed organic data validation for CLP and RCRA data packages for pesticides, PCBs, volatile and semi-volatile analytical fractions. Responsible for the design and implementation of the analytical aspects needed to generate legally defensible data for a Remedial Feasibility Investigation (RFI) at various large chemical plants. Ensured data validation issues were addressed in the day-to-day operations of the investigation.

Gas Chromatography Supervisor, West-Paine Laboratories, Baton Rouge, LA, 1991-1993

Directly responsible for the supervision of the organics laboratory in environmental and hazardous waste matrices following current SW-846, 500 and 600 series methodologies. Responsibilities include coordinating and managing of QA/QC for all Gas Chromatography data from sample login, extraction, analysis, review and preparation of computerized reports.

Previous Experience:

Gas Chromatography Laboratory Manager, ETC/Toxicon, Baton Rouge, LA, 1987-1991

Supervised the Gas Chromatography laboratory in the analysis of Organochlorine and Organophosphorus Pesticides, PCBs, Herbicides, PNAs, VOA and Semi-VOAs; supervised all aspects of the GC laboratory including analysis, data interpretation, report preparation, instrument maintenance, method development, and problem solving. In 1990 temporarily relocated to Edison, New Jersey to restructure the Gas Chromatography division while also implementing USEPA CLP and Finnigan QA Formaster; maintained efficiency of twenty-two various Gas Chromatographs.

Education:

BS, Environmental Engineering , Columbia Southern University

ITS Managerial Training Skills Workshop - 1993

Finnigan QA Formaster Training

Restek Chromatography Class

Bank One Managing and Financing Independent Business - 16 Hours - October 1998

CURTIS A. EKKER

Current Position:

Data Validation Manager, GCAL Inc., Baton Rouge, LA, January 1997 - Present

Responsible for validation of final reports. This includes correlation of data between departments, review of chain of custody, review of reported QC, verification of correct reporting level, and review of narratives.

Previous Experience:

Data Validation Manager, ITS-Environmental Laboratories, Baton Rouge, LA, September 1993 - January 1997

Responsible for validation of final reports.

General Chemistry Supervisor, ITS – Environmental Laboratories, Baton Rouge, LA, June1989 - September 1993

Responsible for supervising the work of 11 analysts. This includes training all new employees to follow EPA Protocol in work and to bring their proficiency up to an acceptable level of productivity. Ensure all analytical work is performed and reported with customer time requirement. Ensure that new and infrequently analyzed parameters are properly analyzed. Involved in setting up new analytical methods for Wet Lab. Responsible for generation, implementation, and maintenance of Standard Operating Procedures.

General Chemistry Laboratory Technician, West-Paine Laboratories, Baton Rouge, LA., June 1988 - June 1989

Responsible for preparation and analysis of samples by wet chemistry methods. Instrumentation included flashpoint tester and HACH spectrophotometer. Additional responsibilities included initial review of data and associated QC and entry into the LIMS.

Education:

BS Chemistry, Southeastern Louisiana University, Hammond, LA, 1988.

ITS Managerial Training Skills Workshop - 1993, 1994

Curtis A. Ekker
Page 2

Education:

Dionex Ion Chromatography Training Course - 1991

Data Validation - ACS Short Course - March, 1995

ITS - Environmental Laboratories, Baton Rouge, Manager and Supervisor Retreat - June 1996

ExecuTrain Microsoft Excel 5.0 Beginning For Windows - July 1996

Member - ACS

DANA MERRILL

Current Position: **Senior Project Manager, GCAL Inc., November 2000 - Present**

Act as the main point of contact for the client in the laboratory. Provide technical information to clients and keep them informed of project progress. Coordinate and schedule projects with various departments within the laboratory according to the customers analytical and turnaround requirements. Review chains of custody, login reports and final reports.

Previous Experience: **Project Manager, GCAL Inc., August 1994 - March 1999**

Act as the main point of contact for the client in the laboratory. Provide technical information to clients and assist with analytical needs. Review client C-O-C's and reports. Generate client invoices. Create project and site codes to allow for better handling of client samples. Disseminate information internally regarding projects and specific client needs. Document all communications with client.

GC/MS Analyst, American Analytical & Technical Services, March 1992 - July 1994

Responsibilities included analysis of environmental samples for volatile and semi-volatile constituents utilizing GC/MS systems (HP Series 5970, 5971, and 5972, with RTE-A and Chem Station Data Systems). Responsibilities also involved the creation of CLP and SW846 data packages using EPA approved methodologies and protocols including but not limited to: Methods 500, 600, 8000 series. Daily duties involved sample management, routine maintenance of analytical equipment and the preparation of calibration and quality control standards.

GC/MS Group Leader, ITS- Environmental Laboratories, January 1989 - February 1992

Coordination and scheduling of projects according to priority, hold times and work load. Review and validate data and generate quantitative analysis reports for release to clients. Responsibilities included analysis of environmental samples for volatile and semi-volatile constituents utilizing GC/MS systems (HP Series 5970, RTE-E and RTE-A Data Systems). Responsibilities also involved the creation of CLP and SW846 data packages using EPA approved methodologies and protocols

including but not limited to: Methods 500, 600, 8000 series. Daily duties involved sample management, routine maintenance of analytical equipment and the preparation of calibration and quality control standards. Also responsible for training of department personnel. Supervision of 4 employees.

Organic Extraction/GC Group Leader, West Paine Laboratories, August 1987 - January 1989

Responsible for scheduling and inter-laboratory coordination of projects. Review and validate GC data and generate quantitative analysis reports for release to clients. Daily duties involved sample management, routine maintenance of analytical equipment and the preparation of calibration and quality control standards. Also responsible for training of department personnel. Supervision of 6 employees.

GC Operator, West Paine Laboratories, November 1986 -August 1987

GC operations for the purpose of analyzing extractable constituents. Review GC data and generate quantitative analysis reports for review prior to release to clients.

Lab Technician, West Paine Laboratories, May 1986 -November 1986

Prepared environmental samples for GC and GC/MS according to SW846 methodology.

Education: Mary Carroll High School
Corpus Christi, TX 1966 Graduate
Mathematics and Science Curriculum

Hewlett Packard Short Course, Introduction to MS Interpretation, May 1991

CAROLYN A. DICHARRY

Current Position:

Project Manager, GCAL Inc., Baton Rouge, LA, November 1999 - Present

Responsible for management of client projects and project management activities within the laboratory. Serves as the interface between client and laboratory management to achieve client satisfaction with delivery of analytical results on schedule and to the requested level of quality.

Previous Experience:

QA/QC Assistant, GCAL Inc., Baton Rouge, LA, July 1998 – November 1999

Responsible for assisting in implementing and monitoring the laboratory Quality Assurance Program Plan, conducting monthly internal audits, calibrating thermometers and mechanical pipets, and updating employee training files.

Supervisor, Asbestos Laboratory and Industrial Hygiene Laboratory Director, GCAL Inc., Baton Rouge, LA, January 1997 – July 1998

Responsibilities include management, supervision, staffing, and training all asbestos personnel. Client relations, writing contracts and bids, court consultants, and business development. Formulating all QA/QC manuals, operations, analyses and procedures which adhere to EPA protocol for PLM and PCM. Ordering, designing, and maintaining analytical equipment and laboratory facilities. Organization of intra and inter laboratory proficiency. Additional responsibilities include the administration of the industrial hygiene laboratory.

Supervisor, Asbestos Laboratory, ITS - Environmental Laboratories, Baton Rouge, LA, December 1991 - January 1997.

Responsibilities include management, supervision, staffing, and training all asbestos personnel. Client relations, writing contracts and bids, court consultants, and business development. Formulating all QA/QC manuals, operations, analyses and procedures which adhere to EPA protocol for PLM and PCM. Ordering, designing, and maintaining analytical equipment and laboratory facilities. Organization of intra and inter laboratory proficiency.

Geologist/Microscopist, West-Paine Laboratories, Inc., Baton Rouge, LA., January 1991 - December 1991.

Responsibilities include Phase Contrast Microscopy Analysis (PCM), Polarized Light Microscopy Analysis (PLM), Scanning Electron Microscopy Analysis (SEM) and Inter-Laboratory Quality Control Program for PCM and PLM analysis.

Lab Technician, Kemron Environmental Services,, Baton Rouge, LA., May 1989 - December 1989.

Responsibilities included Polarized Light Microscopy Analysis and Phase Contrast Analysis.

Education:

Secondary Education Degree, Nicholls State University, Thibodaux, LA., 1987

BS, Geology, Nicholls State University, Thibodaux, LA., 1984

Sampling and Evaluating Airborne Asbestos Dust - NIOSH 585 - May, 1989

ITS- Environmental Laboratories, Laboratory Skills Training Program, August -1995

ITS Managerial Training Skills Workshop - 1993,1994

ITS - Environmental Laboratories , Baton Rouge, Manager and Supervisor Training Retreat - June 1996

Executrain Microsoft Excel 5.0 Beginning For Windows - July, 1996

JAMES D. TURNER

Current Position:

Project Manager, Gulf Coast Analytical Laboratories, Baton Rouge, LA, October, 2004 - Present

Responsible for management of client projects and project management activities within the laboratory. Served as the interface between client and laboratory management to achieve client satisfaction with delivery of analytical results on schedule and to the requested level of quality.

Previous Experience:

QC Lab Manager, The Wright Group, Inc., Crowley, LA
March 2004 – October 2004

Responsible for the management of a neutraceutical laboratory for a food fortification company.

Organics Manager, Gulf Coast Analytical Laboratories, Baton Rouge, LA, June 2001- February 2004

Responsible for the management of the GC, GCMS, and the extraction departments of the laboratory.

Training Officer, Gulf Coast Analytical Laboratories, Baton Rouge, LA , January 2000 - 2001

Responsibilities include development of a company training program that will efficiently train employees to ensure compliance with the internal SOP's and the analytical methods. The officer will be responsible for initial training of new employees as well as ongoing training for all employees. The officer will also maintain the training records and the analyst certification program.

General Chemistry Supervisor, Gulf Coast Analytical Laboratories, Baton Rouge, LA, January 1997 - Present

Responsible for the supervision and training of personnel, conducting inorganic analysis using EPA methodologies, correlation and validation of data, maintenance of Standard Operating Procedures (SOPs) and instrumentation, method set up and day-to-day management of the general chemistry laboratory.

General Chemistry Department Group Leader, ITS -Environmental Laboratories, Baton Rouge, LA, August 1996 - January 1997

Responsible for analyst training, instrument maintenance, and scheduling daily work loads.

General Chemistry Laboratory Technician, ITS -Environmental Laboratories, Baton Rouge, LA, November 1992 - August 1996

Responsible for preparation and analysis of standards and samples for most wet chemistry tests. Experience on instrumentation includes Lachat Quick Chem Analyzer, TOC, TOX, HACH Spectrophotometer, IC, HPLC, GCMS, and GPC. Additional responsibilities included initial review of data and associated QC and entry into the LIMS.

Chemist, La-Mar-Ka Chemical, Baton Rouge, LA, November 1991 - November 1992

Responsible for preparation and standardization of chemical solutions. Instrumentation experience included D.L. 40 Auto Titrator and Moisture Analyzer.

General Chemistry Laboratory Technician, Enviromed Laboratories, Baton Rouge, LA, June 1988 - November 1991

Experience includes preparation and analysis of samples by wet chemistry methods and preparation of samples by organic extraction procedures. Introduced to GC/MS. Assisted with sample collection and waste disposal.

Education:

BS, Microbiology, Louisiana State University, Baton Rouge, LA, May 1999
Minor-Chemistry

OSHA 40 hour Hazardous Waste Training Course - August 1991

ITS - Environmental Laboratories, Laboratory Skills Training Program - August 1995

ITS - Environmental Laboratories, Basic Gas Chromatography Theory - May 1996

Current Position:

Controller and Human Resources Director, GCAL Inc., Baton Rouge, LA, January 1997 - present

Responsible for supervision of the Accounts Receivable, Purchasing and Accounts Payable Departments. Included are responsibilities for payroll, collections, and cash management. Additional responsibilities include preparation of capital expenditure requests and reconciliation of the requests with the budget. Shares the budget preparation duty with the General Manager. Maintains the General Ledger and Accounts Payable on AccPac Accounting System on a Novell Network. Human Resources responsibilities include advertising for positions, interviewing applicants, and employee benefits.

Previous Experience:

Controller, ITS - Environmental Laboratories, Baton Rouge, LA, June 1990 -January 1997
Human Resources Director, ITS Testing - Environmental Laboratories, Baton Rouge, LA, 1993 - January 1997

Responsible for supervision of the Accounts Receivable, Purchasing and Accounts Payable Departments. Included are responsibilities for payroll, collections, and cash management. Prepares monthly reports for corporate office and prepares Capital Expenditure requests and reconciles requests to the budget. Budget preparation is a joint duty of the Controller and the Chief Operations Officer. Maintained the General Ledger and Accounts Payable on an automated function run on the HP3000 and on AccPac Accounting System on the Novell Network. Human Resources responsibilities include advertising for positions, interviewing applicants, and employee benefits.

Director of Business & Operations Services, University Relations and Development, Louisiana State University, Baton Rouge, LA., May 1985 - June 1990

Department handles all phases of accounting and computer work in the division. Operate an IBM System 36 computer, which was upgraded in 1986 to accommodate the new programs and database being maintained. Installed a general ledger system, which is now in use by all areas of this division.

Previous Experience:

Corporate Controller, B. Olinde and Sons, Inc., Baton Rouge, LA., October 1980 - May 1985

Responsible for all phases of the accounting for the multifaceted business. Responsible for installation of a general ledger package, which would integrate with the packages in place and began automating the general ledger.

Education:

BS, Microbiology, Louisiana State University, 1986

MS, Food Science/Experimental Statistics, Louisiana State University, 1974.

CPA Preparatory Program, Louisiana State University, 1978

CPA Certificate, October 1979

Cornell - ITS Executive Development Program - August 1991

ITS Managerial Training Skills Workshop - 1993, 1994

ITS Environmental Laboratories - Baton Rouge, Manager and Supervisor Training Retreat, June 1996

Member - Society of Louisiana Public Accountants

Member – Louisiana Notary Association, Notary Certificate – November 1993

APPENIDX B

EQUIPMENT	MAKE/MODEL	SERIAL NUMBER
GCMSSV 1	AGILENT 5973	US10441235

EQUIPMENT	MAKE/MODEL	SERIAL NUMBER
	AGILENT 6890N	US10134037
GCMSSV 3	AGILENT 5973	US3220204
	AGILENT 6890N	CN10407013
GCMSV 0	HP 5890 SERIES II	3336A58851
	HP 5972	3501A02325
GCMSV 2	HP 5890 SERIES II	3029A29908
	HP 5972	3449A02093
GCMSV 3	HP 5890 SERIES II	3033A31455
	HP 5970	3034A12865
GCMSV 4	HP 5890 SERIES II	3336A54720
	HP 5971 A	3050A01785
GCMSV5	HP 5890 SERIES II	3310A48460
	HP 5972	3307A00395
GCMSV6	AGILENT 5973N/G2579A	US44621145
	AGILENT 6890N	CN10452003
PURGE/TRAP(GCMSV-0)	TEKMAR-LSC 2000	88161013
PURGE/TRAP(GCMSV-1)	TEKMAR-LSC 2000	92114001
PURGE/TRAP(GCMSV-2)	TEKMAR-LSC 2000	91162010
PURGE/TRAP(GCMSV-3)	TEKMAR-LSC 2000	90163023
PURGE/TRAP(GCMSV-4)	TEKMAR-LSC 3100	99076013
AUTOSAMPLER(GCMSV-0)	TEKMAR DOHRMANN SOLATEK 72	USO2294002
AUTOSAMPLER(GCMSV-1)	TEKMAR DOHRMANN SOLATEK 72	US02184009
AUTOSAMPLER(GCMSV-2)	TEKMAR ALS 2032/2016	94056005/91113002
AUTOSAMPLER(GCMSV-3)	TEKMAR ALS 2032/2016	92268005/95084019
AUTOSAMPLER(GCMSV-4)	TEKMAR DOHRMANN SOLATEK 72	US02098018
AUTOSAMPLER(GCMSV-5)	TEKMAR DOHRMANN SOLATEK 72	US02205002
FUME HOOD	LABCONCO (#20) GCMSV	
FUME HOOD	LABCONCO(#19)	
COOLER	TRUE(#22)	1330620
REFRIG/FREEZER	SEARS (V0A 2)	983108619
FREEZER	FRIGIDAIRE, MODEL #MFU17F3GW6 (#12) GCMSV	WB02927861
REFRIGERATOR	WPAINE 0570(C6) GCMSV	
GCSV 1	HP 5890 SERIES I	2843A19501
GCSV 2	HP 5890 SERIES II	3133A37433
GCSV 3	HP 5890 SERIES II	3108A34124
GCSV 4	HP 5890 SERIES II	3029A29801
GCSV 5	HP 5890 SERIES II	3033A30601
GCSV 6	HP 5890 SERIES II	3140A38274
GCSV 8	HP 5890 SERIES II	3336A53945
GCSV 11	HP 5890 SERIES II	3033A30303
GCSV 12	AGILENT TECH 6980N	US10338067
GCSV 14	AGILENT TECH 6890N	US10342128

EQUIPMENT	MAKE/MODEL	SERIAL NUMBER
GCSV 15	AGILENT TECH 6890N	CN10413018
EASY FLASH	TDX(GCSV#11)	997776
EASY FLASH	TDX(GCSV#7)	983302
FUME HOOD	LABCONCO(#33)	
GCV1	HP 5890 SERIES II	3336A54138
GCV2	HP 5890 SERIES II	3033A33621
GCV 3	HP 5890 SERIES II	2921A22989
GCV 4	HP 5890 SERIES II	3027A29674
GCV 5	HP 5890 SERIES II	3203A41268
PURGE/TRAP INSTRUMENT 3	LSC 2000	90233008
PURGE/TRAP INSTRUMENT 5	LSC 2000	90211015
PURGE/TRAP INSTRUMENT 1	LSC 2000	93118004
PURGE/TRAP INSTRUMENT 4	OI ANALYTICAL 4560	
AUTOSAMPLER INSTRUMENT 3	TEKMAR ALS 2016	93154002
AUTOSAMPLER INSTRUMENT 3	TEKMAR ALS 2032	95084017
AUTOSAMPLER INSTRUMENT 5	TEKMAR ALS 2032	93076011
AUTOSAMPLER INSTRUMENT 5	TEKMAR ALS 2016	91192015
AUTOSAMPLER INSTRUMENT 1	TEKMAR DOHRMANN SOLATEK 72	USO227705
AUTOSAMPLER INSTRUMENT 4	OI ANALYTICAL DPM-16	
REFRIG/FREEZER	SEARS (#19)	
REFRIGERATOR	DANBY	
REFRIG/FREEZER	MASTERBILT (#18)	254034
BALANCE	METTLER AE200	265273
BALANCE	SARTORIUS AC211P	50305162
REFRIG/FREEZER	WHITE ROPER BY WHIRLPOOL (#25)/RT14BKXK002	VSM0483080
REFRIG/FREEZER	SEARS (#11)	BA01000875
REFRIG/FREEZER	KENMORE (#14)	BA04391055
REFRIG/FREEZER	KENMORE (#15)	BA04391057
REFRIG/FREEZER	KENMORE (#17)	BA03100524
FREEZER	WHITE WESTINGHOUSE (#26)	WB83724994
METALS		
ICP	PERKIN-ELMER OPTIMA 3000XL	069N4051802
ICP	PERKIN-ELMER OPTIMA 4300DV	077N0050202
GFAA	PERKIN-ELMER 4100ZL	6421
HG ANALYZER	PERKIN ELMER/FIMS 400	4515
FUME HOOD—FLOW SCIENCES	FS3100BKFVA	11-j-07-04
FUME HOOD	FS3100BKFVA	11-j-07-15
METALS PREP		
MICROWAVE	CEM MARS5	DS-6208

EQUIPMENT	MAKE/MODEL	SERIAL NUMBER
DIGESTION BLOCKS(3)	CPI MOD BLOCK	
FUME HOOD –FLOW SCIENCES (2)	FS 310	5-0-7
BALANCE	SARTORIUS BASIC B310S	40030070
BALANCE	METTLER AE200	L94570
EXTRACTIONS		
FUME HOODS (18)		
FREON RECYCLER	ENVIROSAVE 22 (NOT IN USE)	
GLASS WASHER	AMSCO 400	36911195001
SHAKER (4)	GLAS-COL 099A	
MILLIPORE(2)		
VACUUM PUMP	WELCH 1397	
GPC (2)	ABC AP-100	9161SI/AS007-9114-9114
CENTRIFUGE	IEC HN-SII	
OVEN	FISHER ISOTEMP 655G	11000184
TCLP/ZHE ROTATOR (7)	ASSOCIATED DESIGN	
ZHE EXTRACTORS (27)	ENVIRONMENTAL EXPRESS	
WATER BATH (3)		
SONICATOR (4)	MISONIX	
INCUBATOR SHAKER	NEW BRUNSWICK SCIENTIFIC/CLASSIC SERIES C24	100524881
BALANCE	METTLER PM 3000	M33557
BALANCE	SARTORIUS U4600 P+	36090160
BALANCE	METTLER PG 3001 S	1117331005
BALANCE	AND FX-300	5015502
PH METER	ORION SA520	QT20A
PH METER	ORION 720A	003964
PH METER	ORION 720A+	085153
PH PROBE/ATC PROBE	ORION SURE-FLOW ROSS 917006	917006
PH PROBE/ATC PROBE	ORION SURE-FLOW ROSS 917006	9107BN
COOLER	TRUE (#5)	1334961
REFRIG/FREEZER	WHITE WESTINGHOUSE (#8)	LA10903763
REFRIG/FREEZER	WHITE WESTINGHOUSE (#9)	BA04391056
REFRIG/FREEZER	KENMORE (#6)	E52036581
FREEZER	WHITE WESTINGHOUSE (#23)	WB40802629
ULTRASONIC CLEANER	FISHER SCIENTIFIC/FS30	RTB040265340
MUFFLE FURNACE	FISHER SCIENTIFIC/ISOTEMP 550 SERIES MODEL 126	410N0074
HPLC		
HPLC	HP 1050 AND ACCESSORIES	
HPLC	HP 1049A	331450G644
HPLC	HP1046A	3137G02313
COLUMN HEATER	EPPENDORF TC-45	
AIR		
MSA1	HP 5890 SERIES II	3336A53261
	HP 5972	3341A01343
DYNAMIC DILUTER	ENTECH INSTRUMENTS/MODEL 4600A	1071
OVEN	LAB-LINE/3513ENT	104-5903

EQUIPMENT	MAKE/MODEL	SERIAL NUMBER
CANISTER CLEANER	ENTECH INSTRUMENTS/MODEL 3100A	1098
PRECONCENTRATOR	ENTECH INSTRUMENTS/MODEL 7100A	1166
WET CHEMISTRY		
TOX (2)	MITSUBISHI TOX-10E	
TOC (3)	SHIMADZU TOC-5050	30N28473/33829608/29118884
AUTOANALYZER	LACHET QUICK CHEM AE	200-474
IC	DIONEX LC20/ED40/AD20/AS40	900915
COD REACTOR (2)	HACH COD REACTOR	910404575/920800007697
TURBIDIMETER	HACH 2100P	960700011424
SPECTROPHOTOMETER	HACH DR/3000	920800003638
SPECTROPHOTOMETER	HACH DR/4000V	0304V0002021
TITRATOR	METTLER TOLEDO DL53	S119484414
VISCOMETER	BROOKFIELD DVII	32587
WATER BATH	BROOKFIELD TC-200	
CLOSED CUP FLASH PT	PRECISION SCIENTIFIC	10BR-12
FLASHPOINT TESTER	HERZOG PENSKY-MARTENS	013291531
AMMONIA PROBE	ORION 95-12	
OXYGEN BOMB CAL	PARR	6616
CONDUCTIVITY METER	OAKTON pH/CON 510 SERIES	79134
COLIFORM BATH	PRECISION SCIENTIFIC INCUBATOR	
PH METER	ORION 420A	7881
PH PROBE	ORION TRIODE	
PH PROBE/ATC PROBE	ORION COMB 915600/917006	
AUTOCLAVE	AMSCO EAGLE TEN /E105P	0429095113
DO METER	YSI MODEL 59/5905 PROBE	93A01946
DO METER	YSI MODEL 5100	99M0821-AF
OVENS (2)	BLUE M SW17TA-1	SW-5478/SW-5408
OVEN	LAB-LINE 3510	0687-0363
OVEN	GRIEVE PL-326	444341
FURNACE	THERMOLYNE 1500	
DESSICATORS (7)	DRY KEEPER	
INCUBATOR	FISHER SCIENTIFIC(#3)	WB93928030
BALANCE	METTLER AE163	C05693
BALANCE	METTLER AX504	1122043050
FUME HOODS (4)		
INCUBATOR (BOD)	REVCO	
INCUBATOR (BOD)	PRECISION SCIENTIFIC	
INCUBATOR (BOD)	FISHER SCIENTIFIC	WB 11908435
INCUBATOR (BOD)	FISHER SCIENTIFIC/MODEL 307C	WB 42941705
REFRIG/FREEZER	WHITE WESTINGHOUSE (#1)	WB10507478
LOG-IN		
FUME HOOD (1)		
COOLER	TRUE (#2)	708391
COOLER	TRUE/GDM-72 (#3)	1-3792963
WALK-IN COOLER (2)		
REFRIG/FREEZER	KENMORE (#4)	BA01902878

EQUIPMENT	*MAKE/MODEL*	*SERIAL NUMBER*
ELECTRONIC THERMOMETER	RAYNGER ST2L RAYTEK	
FREEZER	FRIGIDAIRE(#12) MFU17F3GW6	WB03102969
SCANNER	HEWLETT PACKARD SCANJET 5470C/C9850A	CN1B41HOTZ
FREEZER	FRIGIDAIRE (#28) FFU20FC4CWO	WB34937210
FREEZER	FRIGIDAIRE (#29) FFC15C4CWO	WB40427812
MISCELLANEOUS		
BALANCE	AND FX-300 WEST-PAINE 0640	5015502
BALANCE	SARTORIUS B120S	40030105

CERTIFICATIONS

GCAL Certifications

- Louisiana Department of Environmental Quality, Environmental Laboratory Accreditation Program, NELAP, Certificate Number 01955 (Expiration 6/30/2005)
- Oklahoma Department of Environmental Quality, Laboratory Certification Program, ID # 9403 (Expiration 08/31/2005)
- State of North Carolina, Department of the Environment and Natural Resources, division of Water Quality, Laboratory Certification Program, Certificate # 618 (Expiration 12/31/2005)
- State of Arkansas, Department of Pollution Control and Ecology, Laboratory Certification Program (Expiration 08/02/2005)
- State of Florida, Department of Health, Bureau of Laboratories, NELAP, Lab ID: E87854 (Expiration 06/30/2005)
- State of California Environmental Laboratory Accreditation Program, Certificate Number 2242 (Expiration 05/31/2005)
- U.S. Army Corps of Engineers (USACE) validated laboratory (Expiration 04/16/2005)
- State of Kansas, Department of Health and Environment, NELAP, Certificate No. E-10354 (Expiration 10/31/2005)
- State of Georgia Environmental Protection Division accreditation based on LA –NELAP
- South Carolina Department of Health and Environment Control, Environmental Laboratory Certification Program, Certificate Number: 73006001 (Expiration 06/30/2005)
- State of Illinois Environmental Protection Agency, NELAP Accreditation #200048, Certificate No. 001202 (Expiration 02/17/2006)
- U.S.D.A Foreign Soils Import Permit

APPENDIX H

PLAN ADDENDA